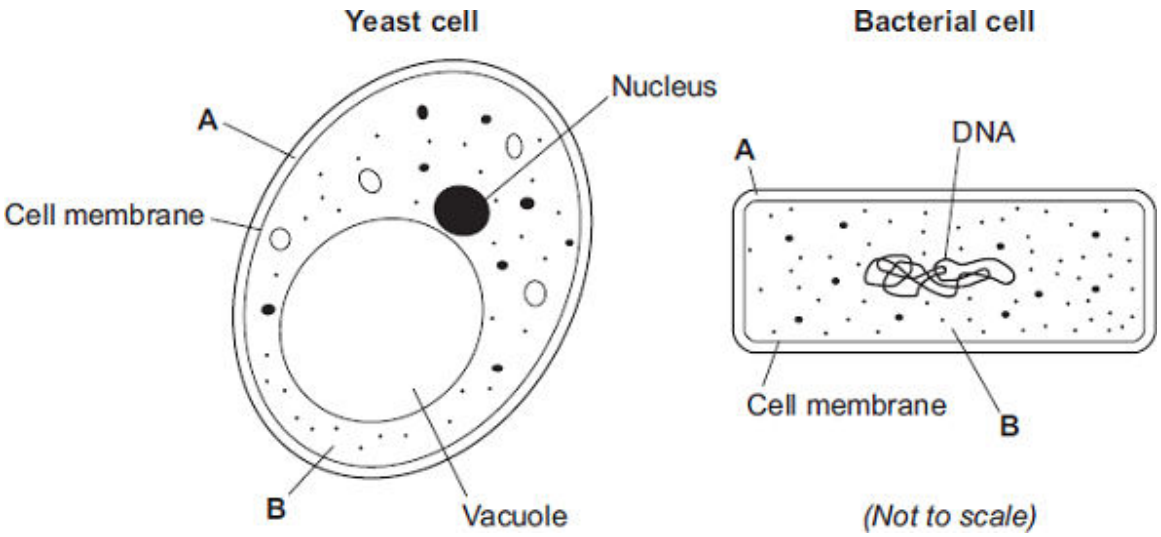
1 (a) The diagrams show the structures of a yeast cell and a bacterial cell.



(i) Both the yeast cell and the bacterial cell have structures **A** and **B**.

Name structures **A** and **B**.

A .....

B .....

(2)

(ii) The yeast cell and the bacterial cell have different shapes and sizes.

Give **one** other way in which the structure of the bacterial cell is different from the structure of the yeast cell.

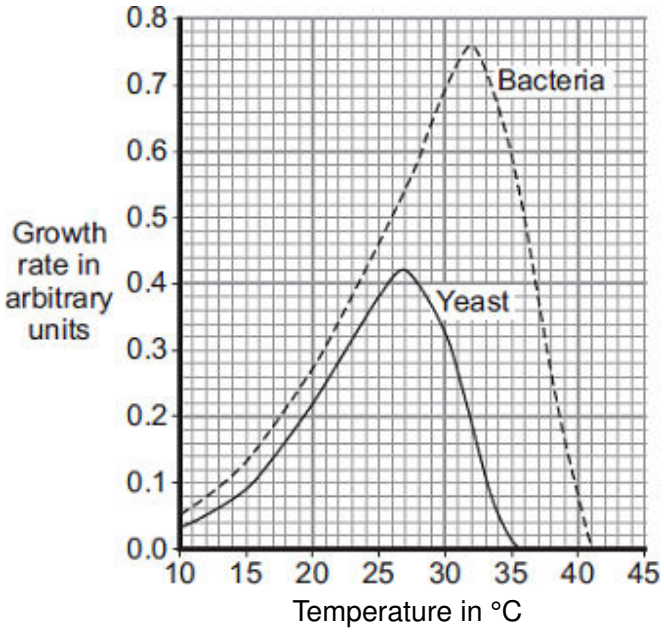
.....

.....

(1)

(b) Sourdough bread is light in texture and tastes slightly sour. The bread is made using two types of microorganism, a yeast and a bacterium. The bacterium can make acids such as lactic acid. The acid makes the bread taste sour.

The graph shows how the growth rates of the yeast and the bacteria change with temperature.



(i) Sourdough bread rises fastest at 27°C.
Use information from the graph to explain why.

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(2)

(ii) The bread tastes most sour if it rises at 32°C.
Use information from the graph to explain why.

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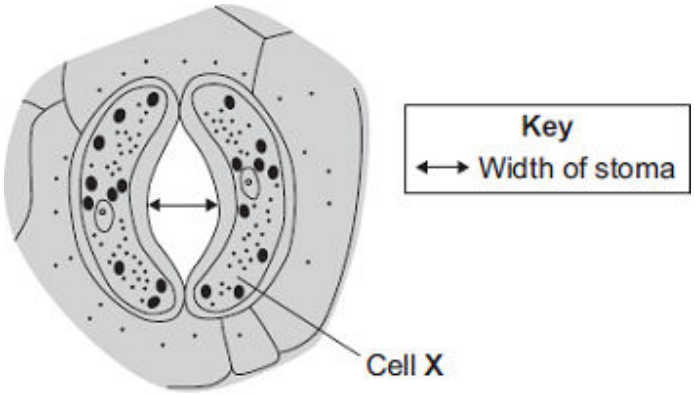
(2)
(Total 7 marks)

2 Plant leaves have many stomata.
The diagram shows a stoma.



(a) Name cell **X** . … … … … … … … … … … … … … …

(1)

(b) The table shows the mean widths of the stomata at different times of the day for two different species of plant.
Species **A** grows in hot, dry deserts.
Species **B** grows in the UK.

	Time of day in hours	Mean width of stomata as a percentage of their maximum width	
		Species A	Species B
Dark	0	95	5
	2	86	5
	4	52	6
Light	6	6	40
	8	4	92
	10	2	98
	12	1	100
	14	0	100
	16	1	96
	18	5	54
Dark	20	86	6
	22	93	5
	24	95	5

The data in the table show that species **A** is better adapted than species **B** to living in hot, dry deserts.

Explain how.

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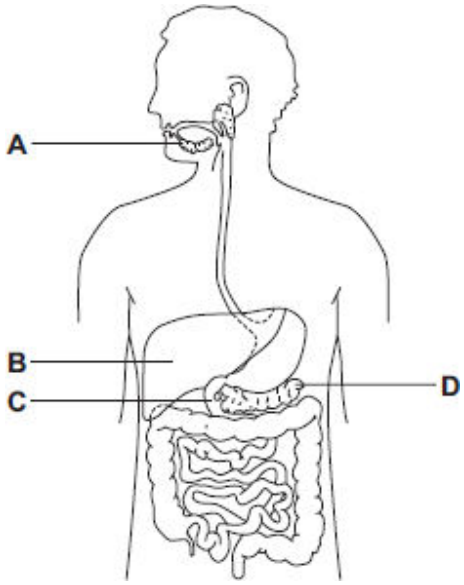
(4)
(Total 5 marks)

3 The diagram shows part of the human digestive system.



(a) Name the parts of the digestive system labelled **A**, **B**, **C** and **D**.

A .....

B .....

C .....

D .....

(4)

(b) A student has eaten a steak for dinner. The steak contains protein and fat.

(i) Describe how the **protein** is digested.

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(3)

(ii) Explain **two** ways in which bile helps the body to digest **fat**.

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(4)

(c) A group of students investigated the action of salivary amylase.
The students:

- collected a sample of salivary amylase
- put a different pH solution and 5 cm^3 of a food substance in each of 6 test tubes
- added 1 cm^3 of salivary amylase to each of the 6 test tubes
- recorded the amylase activity after 10 minutes.

The results are shown in the table.

pH	7	6	5	4	3	2
Amylase activity in arbitrary units	12	10	3	0	0	0

(i) Name the food substance that amylase breaks down.

.....

(1)

(ii) Suggest what happens to the breakdown of this substance when food reaches the stomach.

Use information from the table to help you to answer this question.

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(3)
(Total 15 marks)

4 The number of people in the UK with tumours is increasing.

(a) (i) Describe how tumours form.

.....

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(1)

(ii) Tumours can be malignant or benign.

What is the difference between a malignant tumour and a benign tumour?

.....

.....

(1)

(b) Describe how some tumours may spread to other parts of the body.

.....

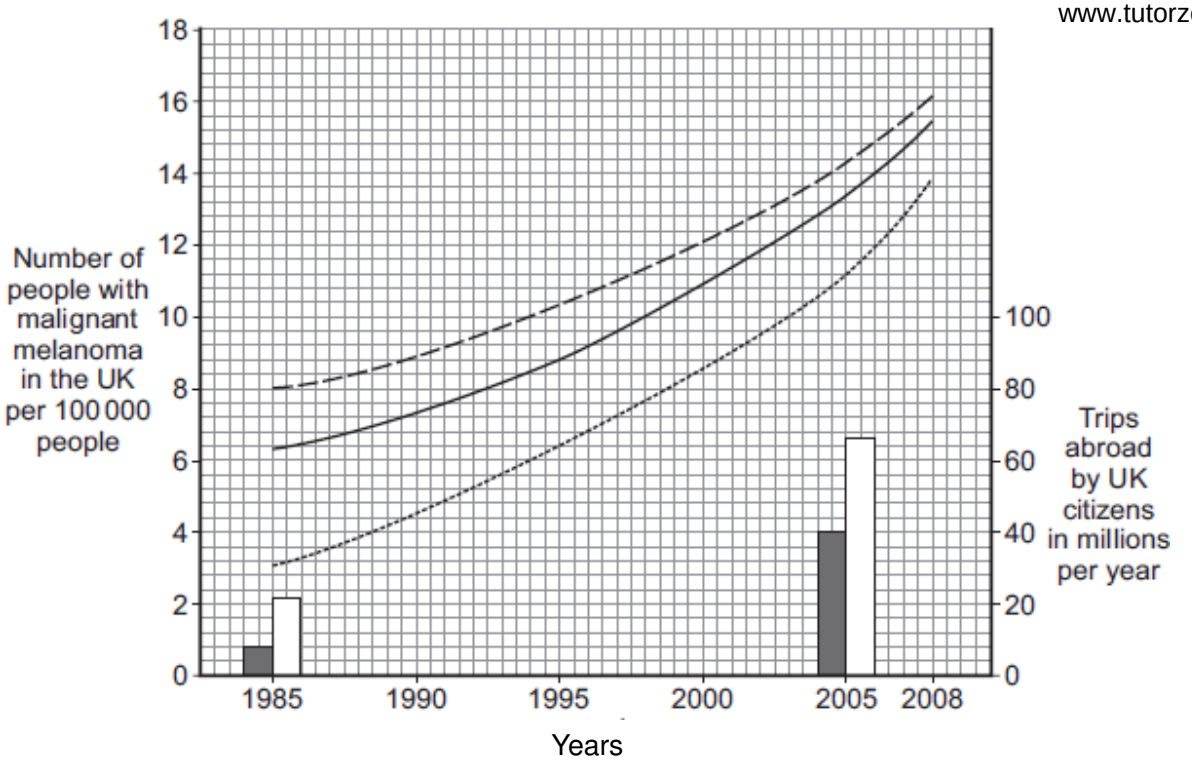
.....

(1)

(c) People from Northern Europe have fair skin and many people have malignant melanoma skin cancer.

The graph shows how the number of people in the UK with malignant melanoma changed between 1985 and 2008.

The bars on the graph show the number of people in the UK who travelled abroad and the number who took cheap holidays in the sun in 1985 and 2005.



Key

——— Mean for all areas
– – – Mean for people from rich areas
—·— Mean for people from poor areas

Total number of trips abroad
Number of cheap holidays in the sun

(i) Describe the trends in the number of people with malignant melanoma skin cancer between 1985 and 2008.

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(3)

(ii) Use the data about the number of trips abroad to suggest an explanation for the trends you have described in part **(c)(i)**.

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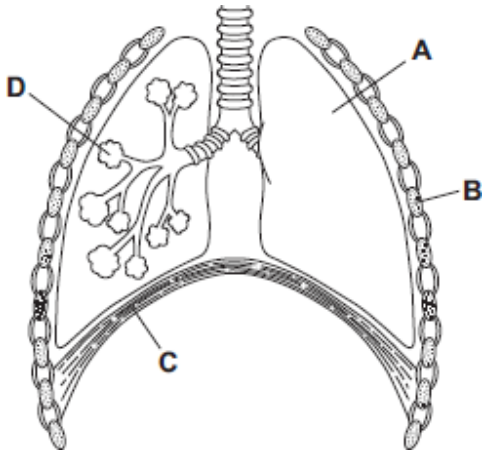
(2)
(Total 8 marks)

5 (a) **Diagram 1** shows part of the breathing system.

Diagram 1



(i) Use words from the box to name the parts labelled **A**, **B**, **C** and **D**.

alveolus	**diaphragm**	**lung**	**rib**	**trachea**

A .....

B .....

C .....

D .....

(4)

(ii) Parts **B** and **C** move when we breathe **in**.

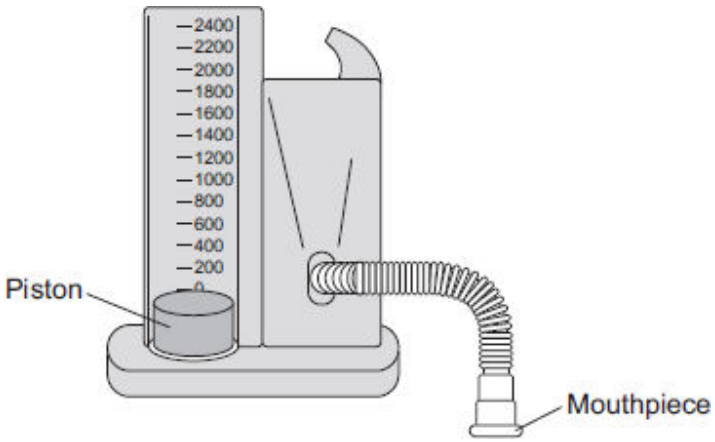
Part **B** moves .....

Part **C** moves .....

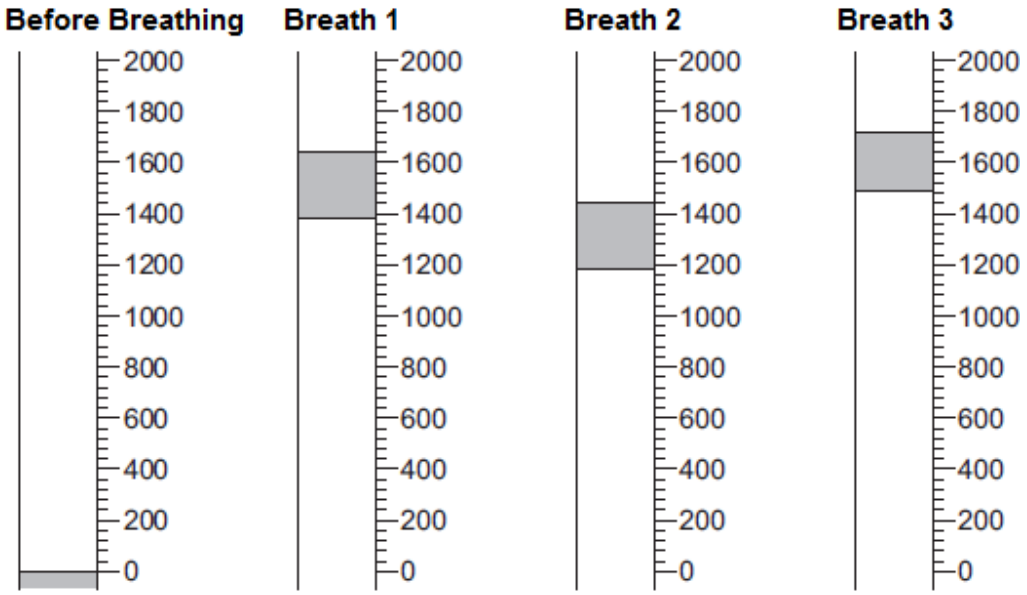
(2)

(b) A student used the apparatus shown in **Diagram 2** to measure the maximum volume of air that he could breathe in one breath.
When the student breathes in, the piston moves upwards.
The piston moves back down after the student has breathed out.

Diagram 2



The student breathes in through the apparatus three times.
The drawings show the position of the piston after each of the three breaths.
The volumes are measured in cm^3.



(i) Read the volume of each breath and write the volume in the table.

	Breath 1	Breath 2	Breath 3
Volume in cm^3	.....	.....	.....

(3)

(ii) Calculate the mean volume of air breathed in.

.....

.....

Mean volume of air breathed in = ... cm^3

(2)

(c) A teacher asks the student to investigate if students who take part in sports activities can breathe in a larger volume of air than students who do not take part.

Describe briefly how the student could use the **same** apparatus to do the investigation.

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(3)

(d) **Photograph 1** shows a different piece of apparatus used to measure the volume of air that a person can breathe in one breath.

Photograph 1

© Digital Vision/Photodisc

When the student breathes out through the apparatus the pointer on the scale moves. The pointer stays in the same position when the student has finished.

Explain **one** advantage, apart from size, of using this apparatus rather than the apparatus described in part **(b)**.

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(2)

(e) **Photograph 2** shows one type of mechanical ventilator.

Photograph 2

© Emine Donmaz/iStock

(i) Use information from **Photograph 2** to suggest how this type of ventilator works.

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.....

(2)

(ii) Use information from **Photograph 2** to suggest two disadvantages of this type of ventilator.

1.....

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2.....

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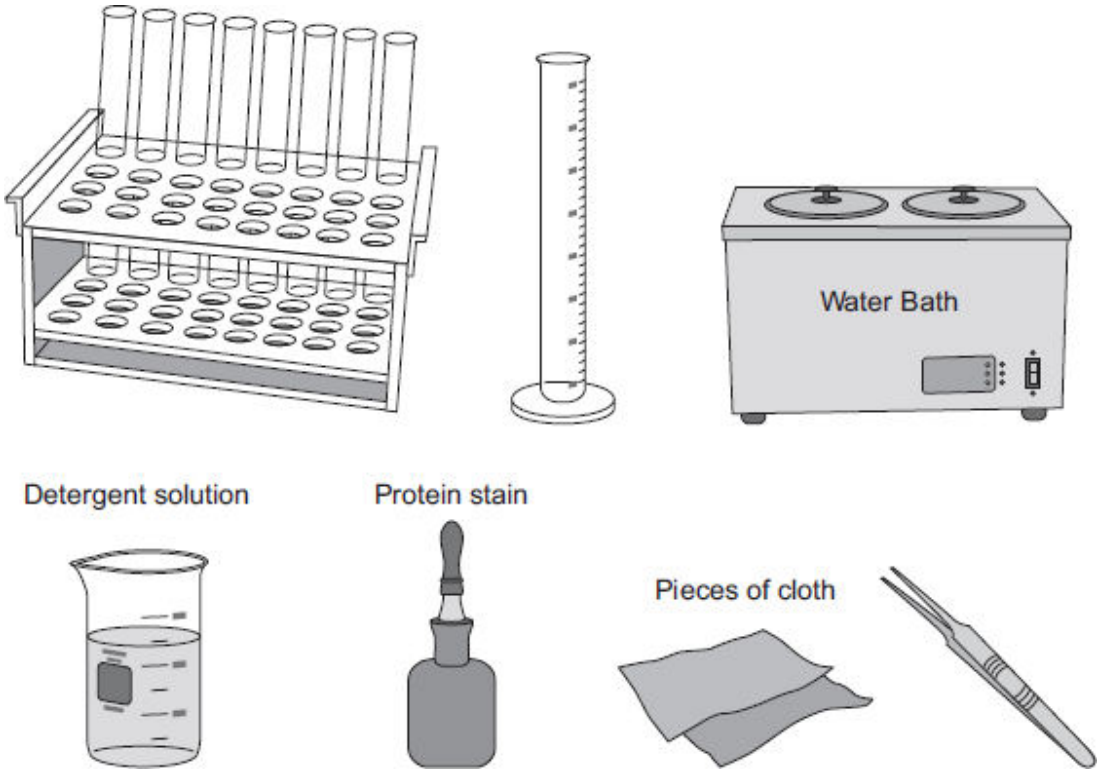
(2)
(Total 20 marks)

6 Biological detergents contain protease enzymes.

(a) The drawings show some apparatus and materials.



In this question you will be assessed on using good English, organising information clearly and using specialist terms where appropriate.

Describe how you would use the apparatus and materials shown in the drawings to find the best temperature for removing stains from clothing.

You should include how you would make the investigation a fair test.

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(6)

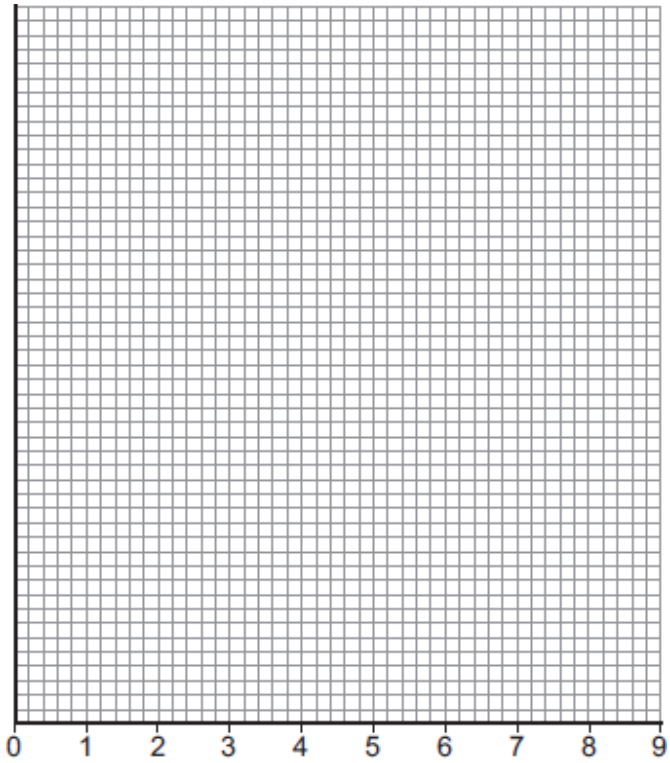
(b) In a similar investigation a student investigated the effect of pH on the time taken to remove a stain from pieces of cloth.

The table shows the student's results.

	pH of detergent solution								
	1	2	3	4	5	6	7	8	9
Time taken to remove stain in minutes	20	19	17	14	10	4	8	12	16

(i) On the graph paper below draw a graph to show the student's results.

- Add a suitable scale and label to the y axis.
- Plot the student's results.
- Draw a line of best fit.



(4)

(ii) Which is the best pH for using the detergent?

pH .....

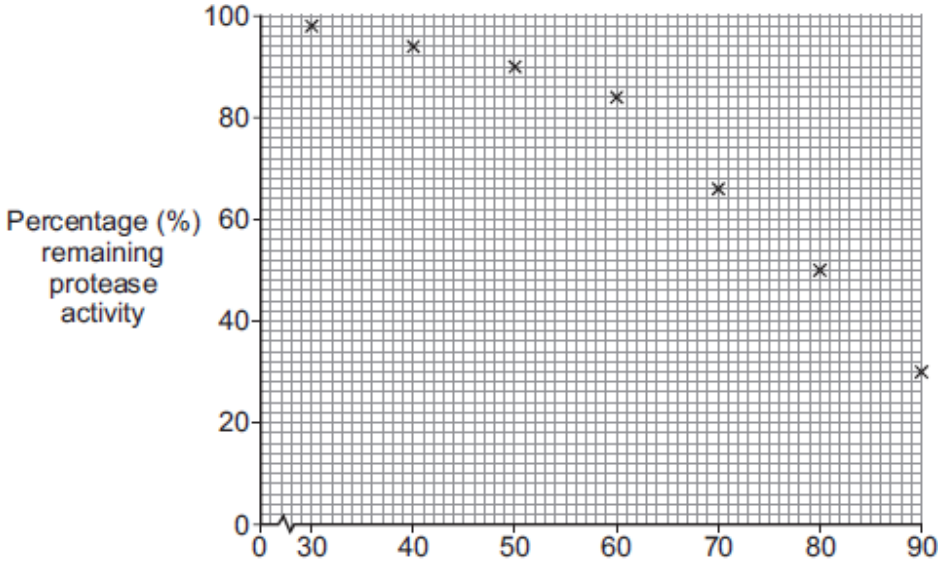
(1)

(c) Scientists investigated the stability of a protease enzyme. The protease enzyme was extracted from plants.

The scientists:

- pre-incubated samples of the enzyme at various temperatures for 30 minutes
- put each sample on ice for a further 10 minutes
- measured the percentage (%) remaining activity of the enzyme in each sample. This was done by incubating each sample with protein at 37 °C for 6 hours.

The graph shows the scientists' results.



The scientists recommended that the enzyme could be used in detergents at a temperature of 60 °C.

Suggest why the scientists recommended a temperature of 60 °C.
Use information from the graph and your own scientific knowledge in your answer.

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(3)
(Total 14 marks)

7 The number of cases of Type 2 diabetes in the UK is increasing rapidly.

(a) Describe how insulin and glucagon help control the blood sugar concentration in a healthy person.

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(6)

(b) What is Type 2 diabetes?

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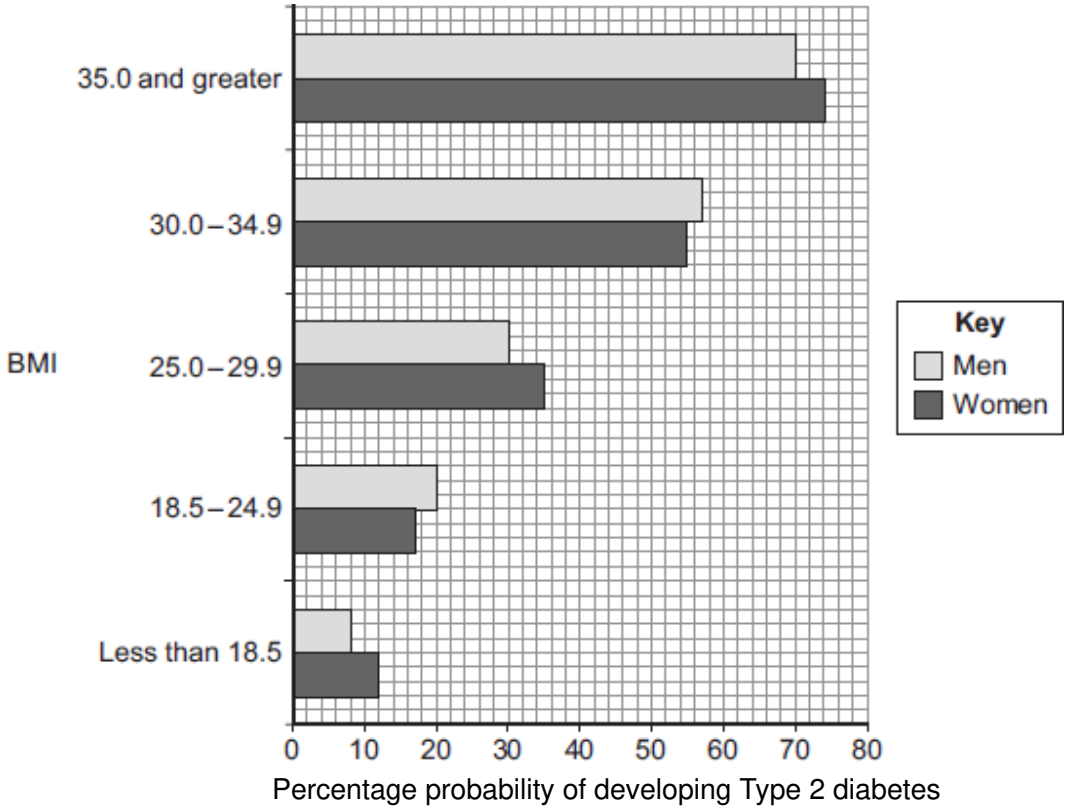
(1)

(c) Body mass index (BMI) is a person's body weight divided by the square of his or her height.

(i) **Graph 1** shows the relationship between BMI and the percentage probability of developing Type 2 diabetes.

Graph 1



Suggest an explanation for the relationship between BMI and the risk of developing Type 2 diabetes.

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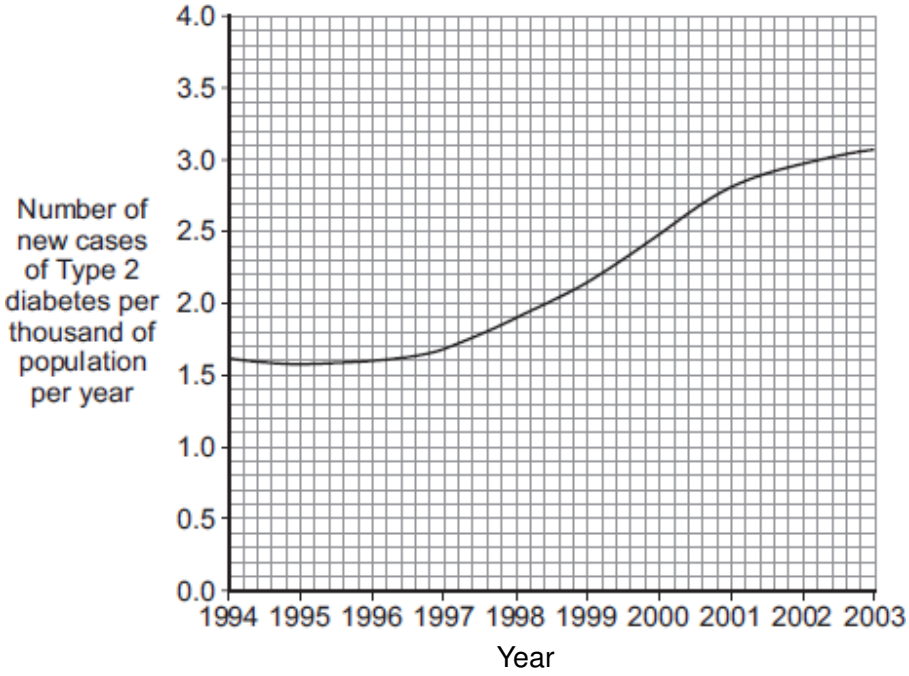
.....

(2)

(ii) **Graph 2** shows changes in the number of new cases of Type 2 diabetes in the UK.

Graph 2



Suggest explanations for the trend shown by the data in **Graph 2**.

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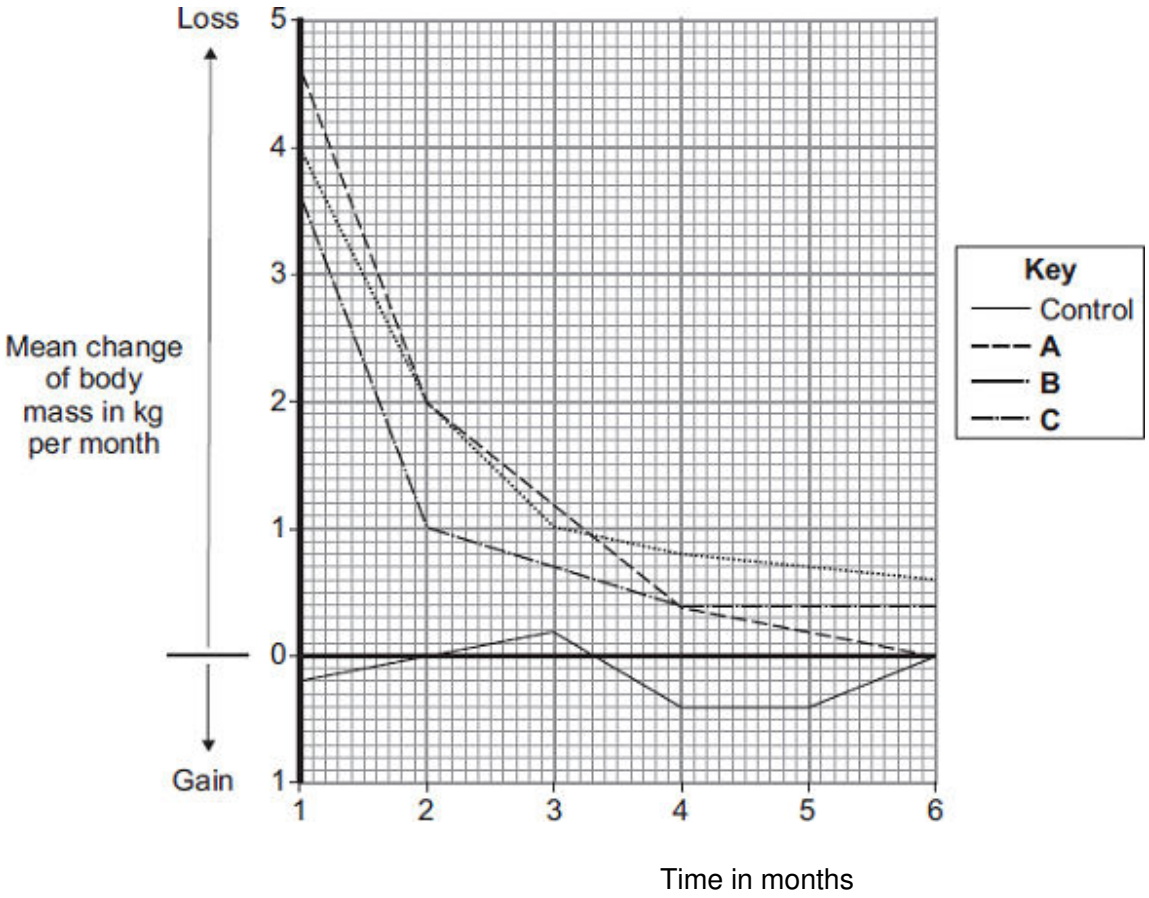
(3)
(Total 12 marks)

8 Scientists investigated the effectiveness of three slimming programmes, **A**, **B** and **C**.

The scientists recorded the body mass of four groups of volunteers each month for 6 months.
Three of the groups were each given a different slimming programme.
The fourth group was a control group.

The graph shows the mean change of body mass each month for all four groups.



(a) (i) What should the control group eat?

.....

.....

(1)

(ii) Why did the scientists include a control group in this study?

.....

.....

(1)

(b) (i) The three groups of volunteers using the slimming programmes each showed a similar pattern of body mass loss over the 6 months.

Describe this pattern.

.....

.....

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.....

(2)

(ii) All the slimming programmes seemed to be effective.

How does the information in the graph show this?

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(1)

(Total 5 marks)

9 One factor that may affect body mass is *metabolic rate*.

(a) (i) What is meant by *metabolic rate* ?

.....

.....

(1)

(ii) Metabolic rate is affected by the amount of activity a person does.

Give **two** other factors that may affect a person's metabolic rate.

1.....

.....

2.....

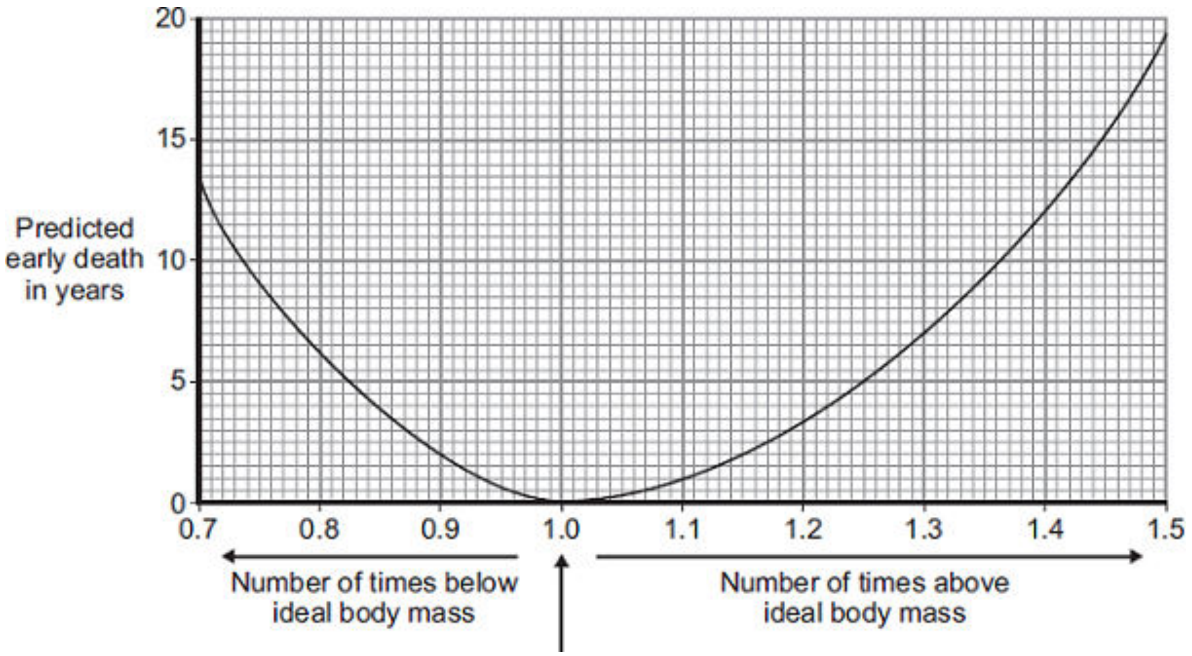
.....

(2)

(b) Predicted early death is the number of years that a person will die before the mean age of death for the whole population. The predicted early death of a person is affected by their body mass.

Scientists have calculated the effect of body mass on predicted early death.

The graph shows the results of the scientists' calculations.



The number of times above or below ideal body mass is given by the equation:

$$\frac{\text{Actual body mass}}{\text{Ideal body mass}}$$

In the UK the mean age of death for women is 82.

A woman has a body mass of 70 kg. The woman's ideal body mass is 56 kg.

(i) Use the information from the graph to predict the age of this woman when she dies.

.....

.....

.....

Age at death = ... years

(2)

(ii) The woman could live longer by changing her lifestyle.

Give **two** changes she should make.

1.....

.....

2.....

.....

(2)
(Total 7 marks)

10 Drugs are used to treat cardiovascular diseases (diseases of the heart and blood vessels).

(a) What is a drug?

.....

.....

(1)

(b) People can be treated for cardiovascular diseases with statins or aspirin.

Information about these two drugs is given in the table.

STATINS	**ASPIRIN**
Statins are only available on prescription from doctors.	Aspirin can be bought over the counter. Treatment with aspirin costs up to £15 per year.
In studies, 30 000 patients were monitored over several years. Statins were found to reduce the rate of non-fatal heart attacks by about 30%.	In a study of 1000 patients, aspirin was found to cause bleeding of the stomach in around 0.5% of patients and there was a slightly increased risk of poor blood clotting at cuts.
Approximately 0.1% of the patients suffered serious muscle damage and 0.01% suffered kidney failure.	There was a slightly increased risk of damage to the blood vessels in the brain in older patients.
Statins reduce blood cholesterol which builds up in the walls of blood vessels. The cost of treating patients with statins can vary between £150 and £500 per year, depending on the type of cardiovascular disease being treated.	Aspirin was found to reduce the risk of non-fatal heart attacks by 31%.

Would you recommend statins or aspirin for the treatment of cardiovascular diseases?

In your answer you should:

- give your recommendation
- use information from the table to support your recommendation by making comparisons of the two drugs.

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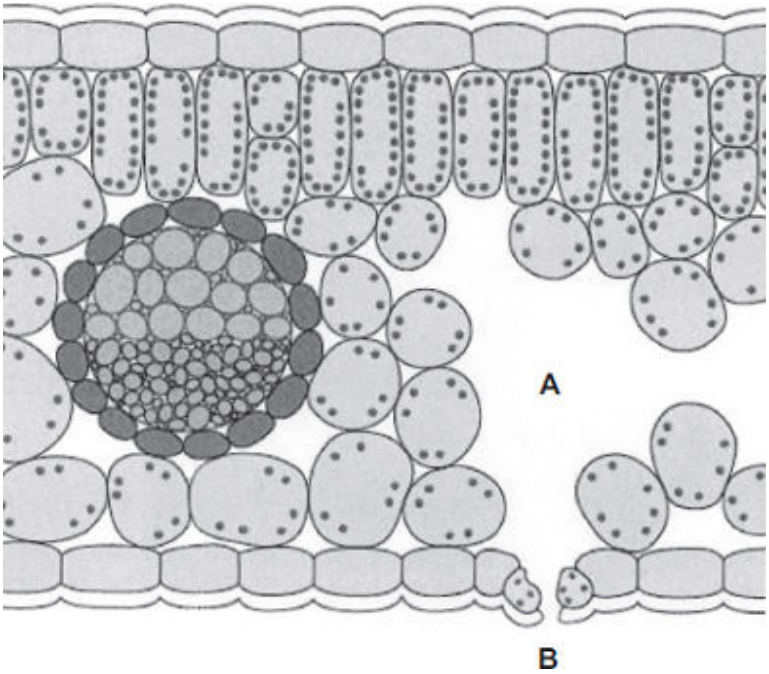
(5)
(Total 6 marks)

11 The diagram shows a section through a plant leaf.



(a) Use words from the box to name **two** tissues in the leaf that transport substances around the plant.

epidermis	**mesophyll**	**phloem**	**xylem**

..... and .....

(1)

(b) Gases *diffuse* between the leaf and the surrounding air.

(i) What is *diffusion*?

.....

.....

.....

.....

(2)

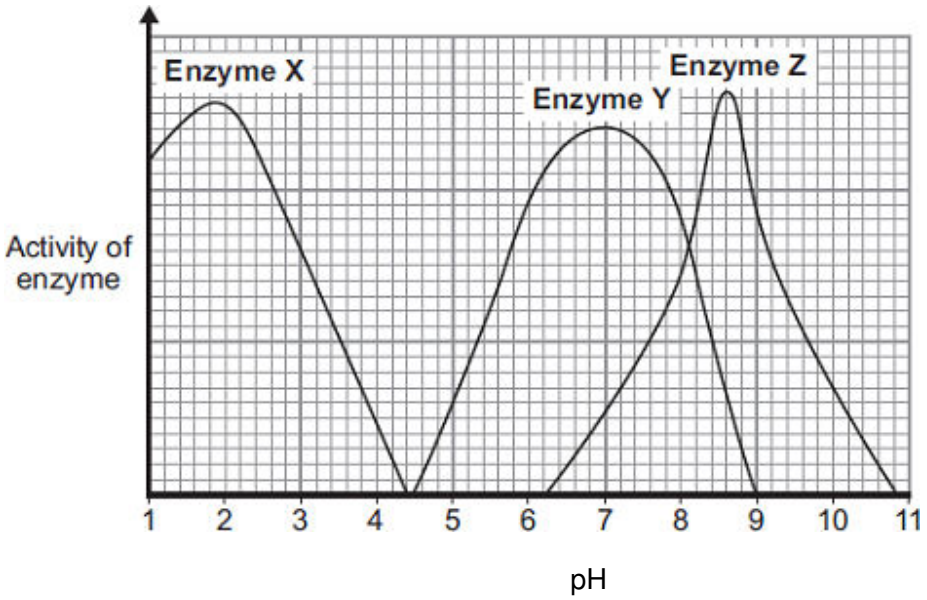
(ii) Name **one** gas that will diffuse from point **A** to point **B** on the diagram on a sunny day.

.....

(1)

(Total 4 marks)

12 (a) The graph shows the effect of pH on the activities of three enzymes, **X**, **Y** and **Z**.
These enzymes help to digest food in the human digestive system.
Each enzyme is produced by a different part of the digestive system.



(i) What is the optimum (best) pH for the action of enzyme **Z**?

.....

(1)

(ii) The stomach makes a substance that gives the correct pH for enzyme action in the human stomach.

Name this substance. .....

(1)

(iii) Which enzyme, **X**, **Y** or **Z**, will work best in the human stomach?

.....

(1)

(b) *In this question you will be assessed on using good English, organising information clearly and using specialist terms where appropriate.*

Different parts of the human digestive system help to break down molecules of fat so that they can be absorbed into the body.

Describe how.

To gain full marks you should refer to:

- the enzyme and where the enzyme is produced
- the products of digestion
- any other chemicals involved.

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(6)
(Total 9 marks)

13 Plants exchange substances with the environment.

(a) Use words from the box to complete each sentence.

alveoli	**phloem**	**root hairs**	**stomata**
storage organs	**villi**	**xylem**	

(i) Most water enters a plant through .....

(1)

(ii) The water is transported up the stem to the leaves in the .....

(1)

(iii) Carbon dioxide enters leaves through .....

(1)

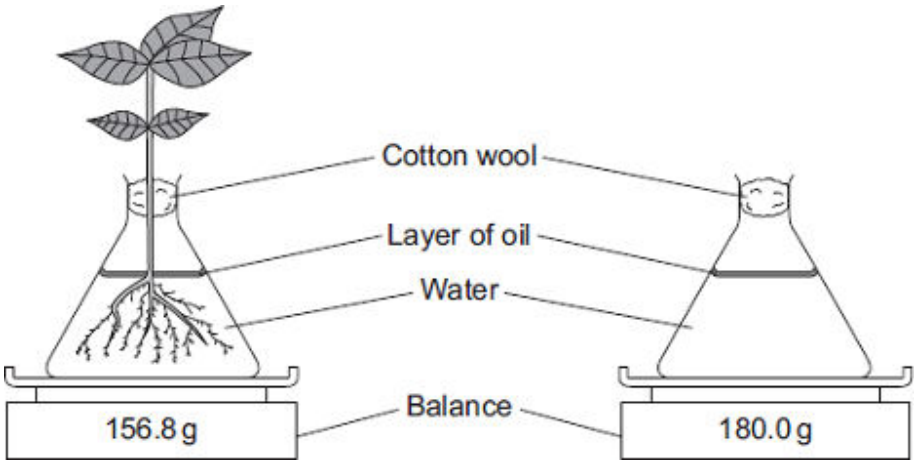
(iv) A leaf uses the carbon dioxide to produce sugars.

Sugars are transported to ..... through the ..... .

(2)

(b) A student set up the apparatus shown in the diagram.

At the start of the experiment both balances showed a mass of 180.0 g.



The diagram shows the reading on each balance 24 hours later.

(i) Look at the mass shown on each balance.

Calculate the difference between the two masses.

.....

.....

Difference in mass = ... g

(1)

(ii) Suggest an explanation for the difference between the two masses.

.....

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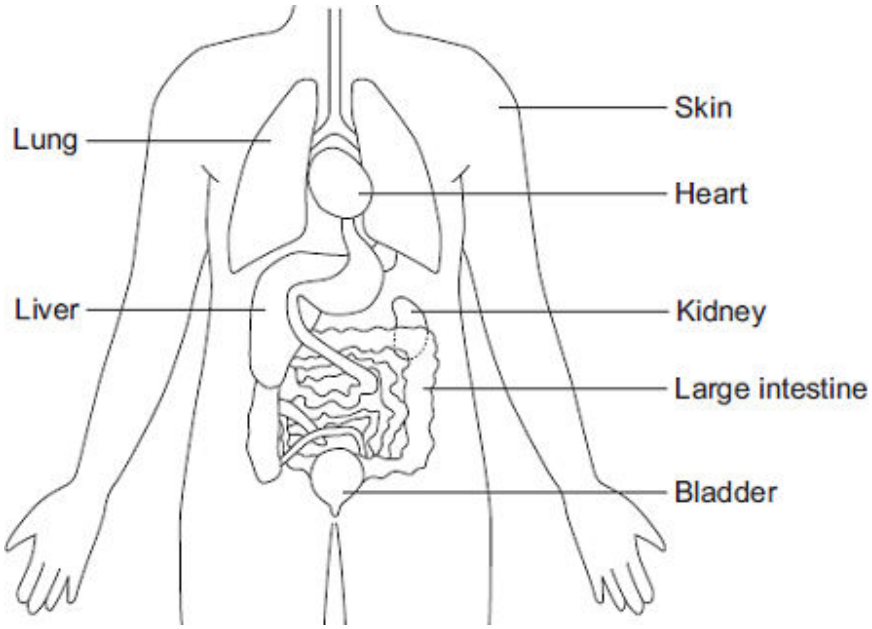
.....

.....

(2)
(Total 8 marks)

14 The diagram shows some of the organs of the human body.



(a) Which organ labelled on the diagram:

(i) produces urine .....

(1)

(ii) stores urine .....

(1)

(iii) produces urea .....

(1)

(iv) gets rid of carbon dioxide .....

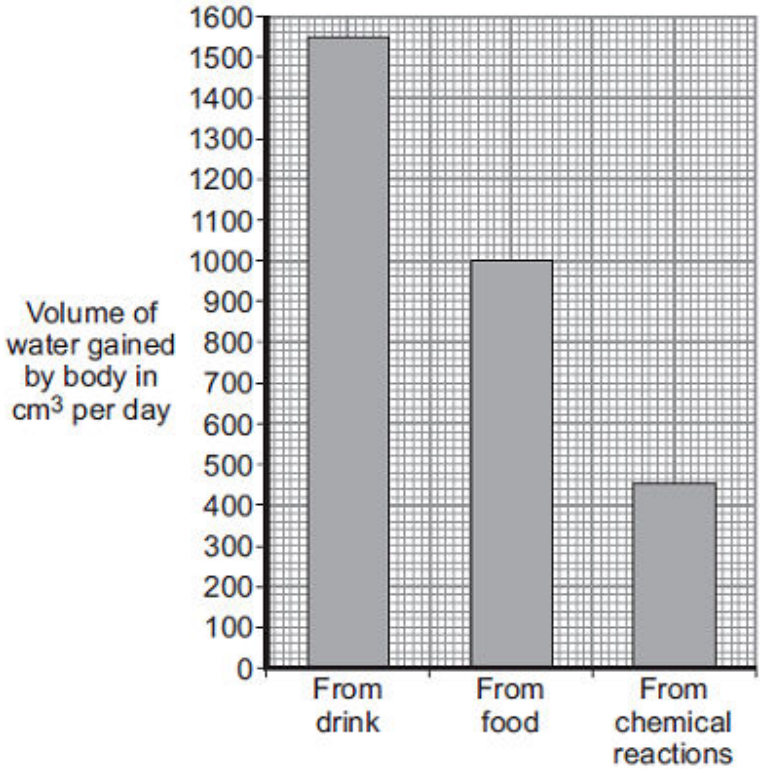
(1)

(v) helps to control body temperature? .....

(1)

(b) **Bar chart 1** shows the volume of water the human body gains each day.

Bar chart 1



Source of water gained by body

(i) Calculate the total volume of water the body gains each day.

.....

.....

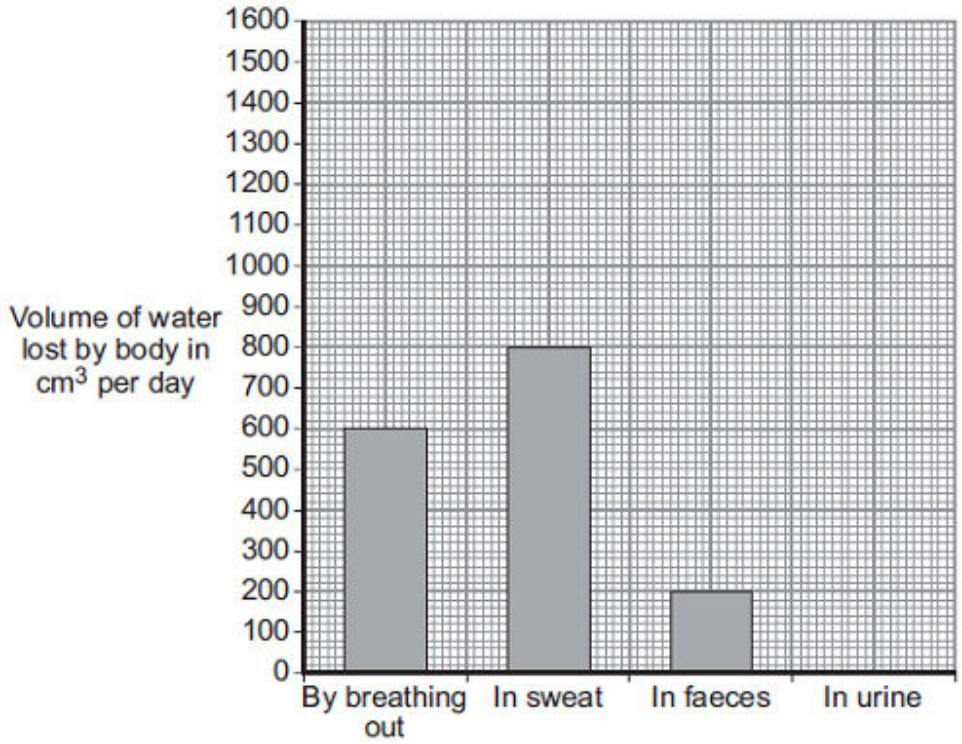
.....

Total volume of water gained = ... cm^3

(2)

Bar chart 2 shows the volume of water lost each day by breathing out, in sweat and in faeces.

Bar chart 2



Water lost by body

(ii) Calculate the total volume of water lost each day by breathing out, in sweat and in faeces.

.....

.....

Volume = ... cm^3

(1)

(iii) The volume of water the body loses must balance the volume of water the body gains.

Use your answers to part (b)(i) and part (b)(ii) to calculate the volume of water lost in urine.

.....

.....

Volume of water lost in urine = ... cm^3

(1)

(iv) Plot your answer to part (b)(iii) on **Bar chart 2**.

(1)

(v) After taking some types of recreational drugs, the kidneys produce very little urine.

What happens to the body cells if the kidneys produce very little urine?

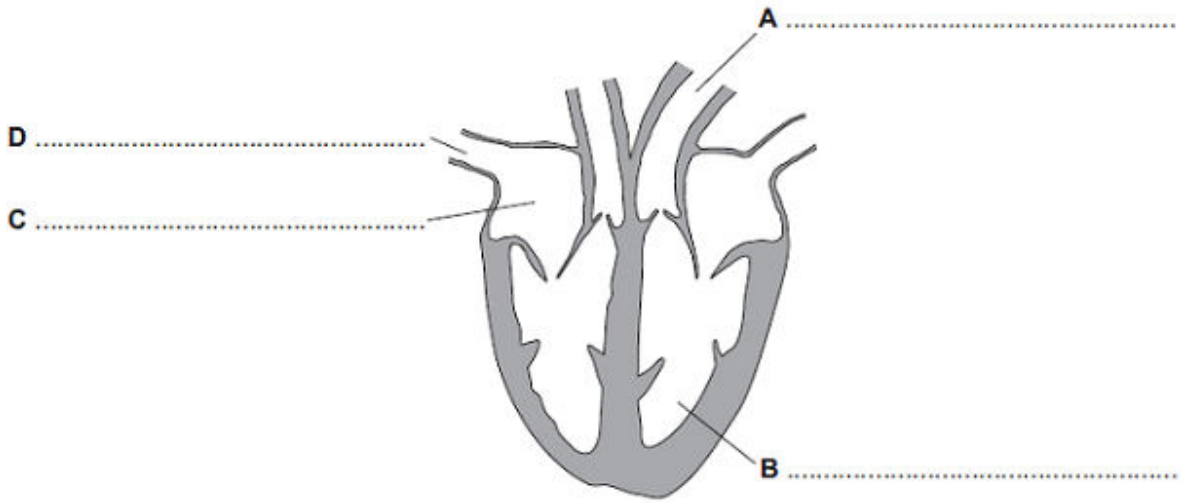
.....

.....

(1)
(Total 11 marks)

15 **Diagram 1** shows a section through the heart.

Diagram 1



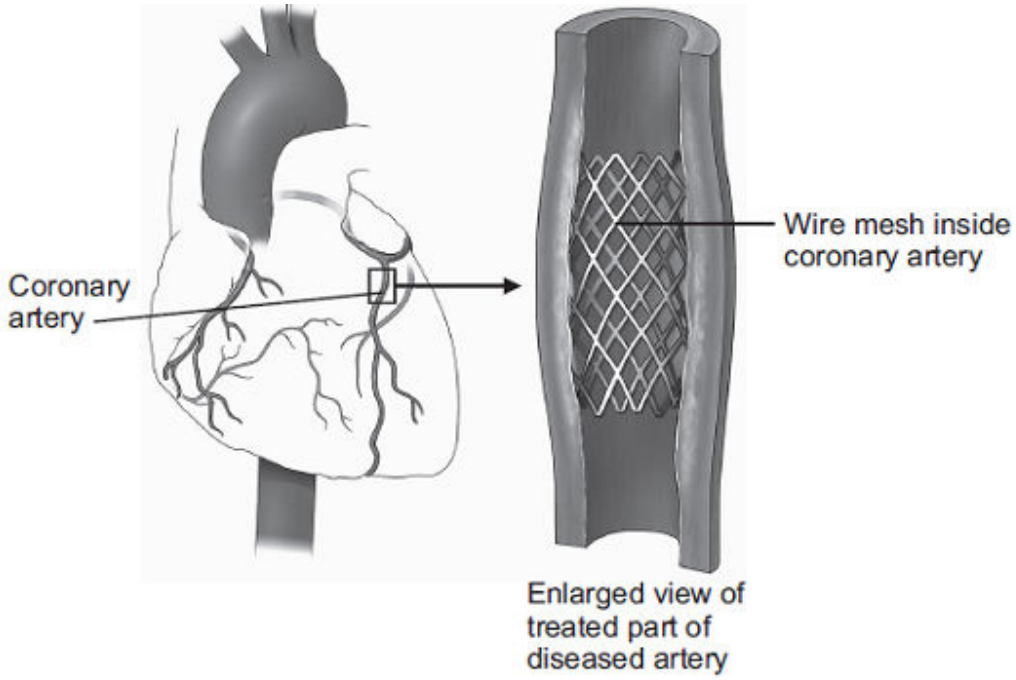
(a) Use words from the box to label parts **A**, **B**, **C** and **D**.

artery	**atrium**	**capillary**	**platelet**	**vein**	**ventricle**

(4)

(b) **Diagram 2** shows one treatment for a diseased coronary artery.

Diagram 2



(i) Name the treatment shown in **Diagram 2**.

.....

(1)

(ii) Explain how the treatment works.

.....

.....

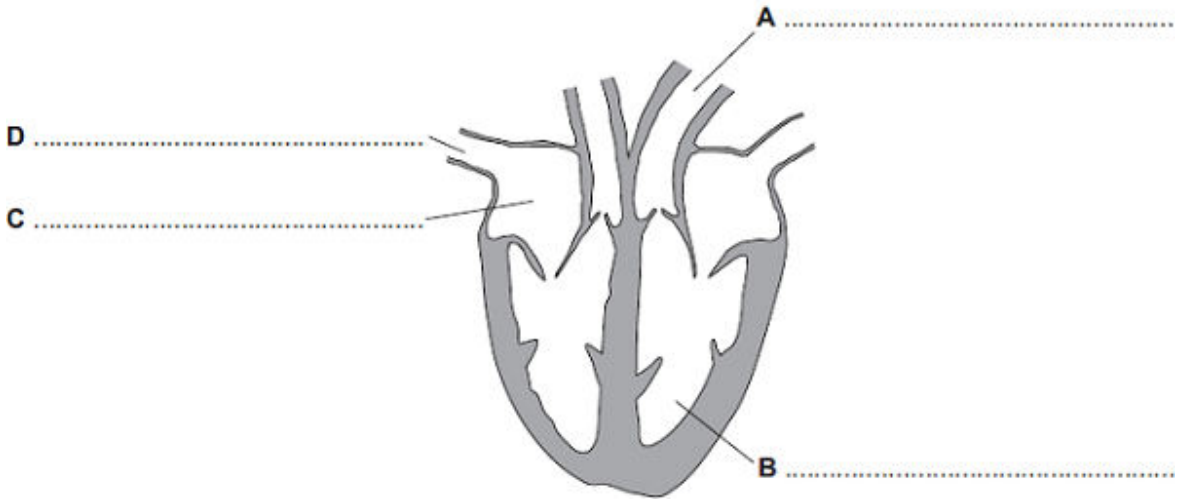
.....

.....

(2)
(Total 7 marks)

16 **Diagram 1** shows a section through the heart.

Diagram 1



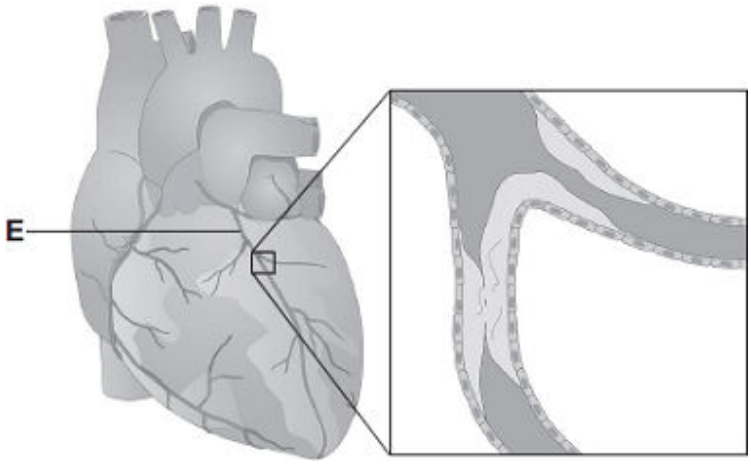
(a) On the diagram, name the parts labelled **A**, **B**, **C** and **D**.

(4)

(b) **Diagram 2** shows the blood vessels that supply the heart muscle.

Part of one of the blood vessels has become narrower.

Diagram 2



(i) Name blood vessel **E**.

.....

(1)

(ii) Give **one** method of treating the narrowed part of blood vessel **E**.

.....

(1)

(iii) Explain how the method of treatment works.

.....

.....

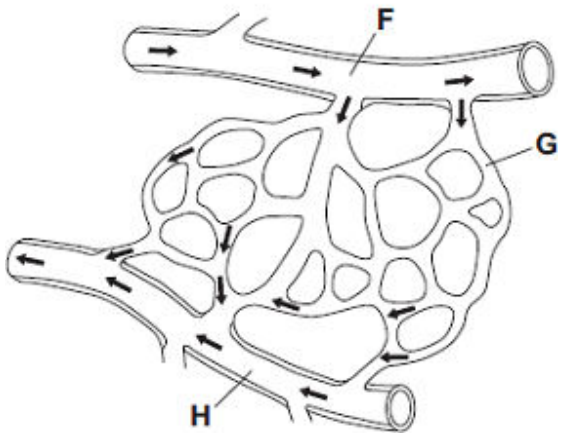
.....

.....

(2)

(c) **Diagram 3** shows part of the blood supply in the lungs.

Diagram 3



(i) Name the types of blood vessel labelled **F**, **G** and **H**.

F.....

G.....

H.....

(3)

(ii) Give **one** way in which the composition of the blood in vessel **F** is different from the composition of the blood in vessel **H**.

.....

.....

(1)
(Total 12 marks)

17 Plants exchange substances with the environment.

(a) Plant roots absorb water mainly by osmosis.
Plant roots absorb ions mainly by active transport.

Explain why roots need to use the two different methods to absorb water and ions.

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(4)

(b) What is meant by the *transpiration stream*?

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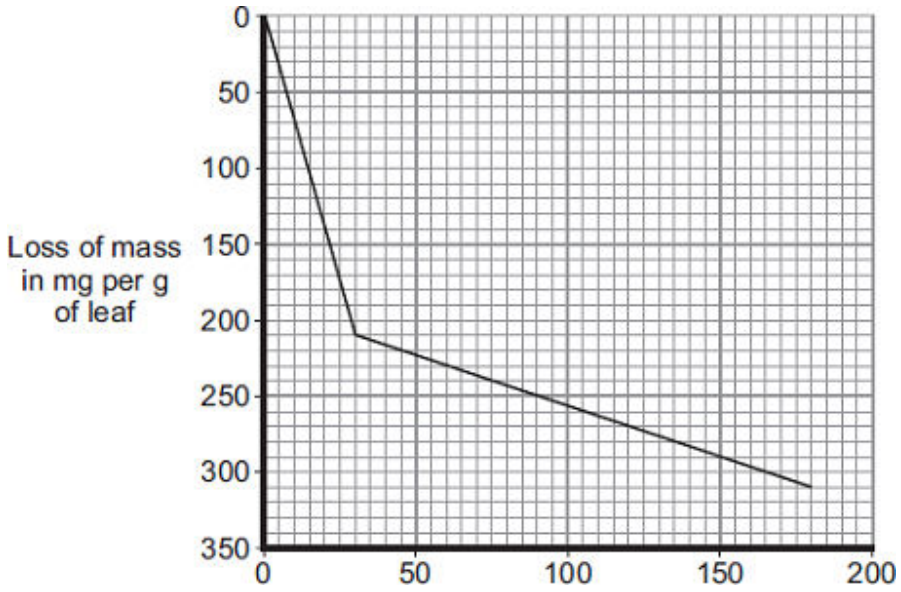
(3)

(c) Students investigated the loss of water vapour from leaves.

The students:

- cut some leaves off a plant
- measured the mass of these leaves every 30 minutes for 180 minutes.

The graph shows the students' results.



(i) The rate of mass loss in the first 30 minutes was 7 milligrams per gram of leaf per minute.

Calculate the rate of mass loss between 30 minutes and 180 minutes.

.....

.....

Rate of mass loss = ... milligrams per gram of leaf per minute

(2)

(ii) The rate of mass loss between 0 and 30 minutes was very different from the rate of mass loss between 30 and 180 minutes.

Suggest an explanation for the difference between the two rates.

.....

.....

.....

.....

(2)

(Total 11 marks)

18 The pancreas and the liver are both involved in the control of the concentration of glucose in the blood.

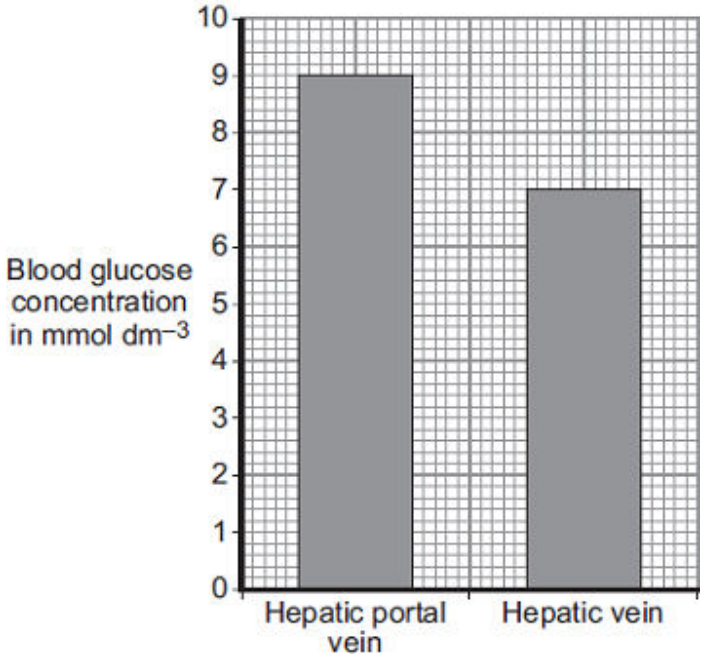
The liver has two veins:

- the hepatic portal vein taking blood from the small intestine to the liver
- the hepatic vein taking blood from the liver back towards the heart.

Scientists measured the concentration of glucose in samples of blood taken from the hepatic portal vein and the hepatic vein. The samples were taken 1 hour and 6 hours after a meal.

Graph 1 shows the concentration of glucose in the two blood vessels 1 hour after the meal.

Graph 1



(a) The concentration of glucose in the blood of the two vessels is different. Explain why.

.....

.....

.....

.....

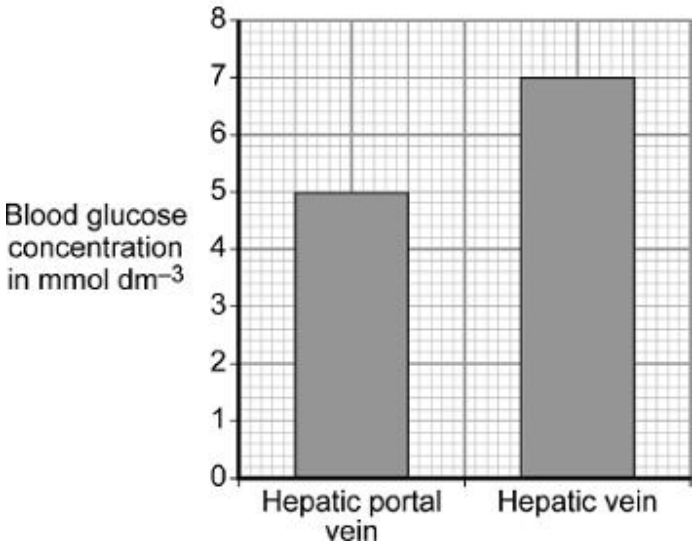
.....

.....

(3)

(b) **Graph 2** shows the concentration of glucose in the two blood vessels 6 hours after the meal.

Graph 2



(i) The concentration of glucose in the blood in the hepatic portal vein 1 hour after the meal is different from the concentration after 6 hours.

Why?

.....

.....

(1)

(ii) The person does **not** eat any more food during the next 6 hours after the meal.

However, 6 hours after the meal, the concentration of glucose in the blood in the hepatic vein is higher than the concentration of glucose in the blood in the hepatic portal vein.

Explain why.

.....

.....

.....

.....

.....

.....

(3)
(Total 7 marks)

19 The table is from a packet of biscuits.

Average values	Per 100 g	Per biscuit	UK guideline daily amounts	
			Adults	Children (5 – 10 years)
Energy	1974 kJ	446 kJ	8500 kJ	7500 kJ
Protein	7.1 g	1.1 g	45 g	24 g
Carbohydrate	62.8 g	9.3 g	230 g	220 g
Fat	21.3 g	3.2 g	70 g	70 g
Sodium	3.6 g	0.5 g	2.4 g	1.4 g

One day a ten-year-old child ate a whole packet of the biscuits.
The biscuits in the pack had a mass of 400 g.

(a) (i) How many grams of carbohydrate did the child eat?

.....

.....

Number of grams .....

(2)

(ii) The amount of carbohydrate you calculated in part (a)(i) was more than the UK guideline daily amount for the child.

How much more?

.....

.....

Number of grams .....

(1)

(b) Give **two** possible health effects on the child of eating so many biscuits every day.

1 .....

2 .....

(2)
(Total 5 marks)

20 Nicotine is a drug in tobacco smoke. Smoking tobacco is harmful.

(a) (i) Many smokers find it difficult to stop smoking.

Complete the sentence.

It is difficult to stop smoking because nicotine is very ..... .

(1)

(ii) Nicotine affects synapses in the brain.

What is a synapse?

.....

.....

(1)

(b) A drug company has developed a new drug, Drug **A**, to help people stop smoking.

Doctors tested the drug in a double-blind trial with over 2000 volunteers who weresmokers.

The volunteers wanted to stop smoking.

The volunteers were divided into three groups. Each volunteer took a tablet once a day for 12 weeks:

- group 1 took Drug **A**
- group 2 took Drug **B** (a drug already in use to stop people smoking)
- group 3 took a placebo.

The smoking habits of each group were recorded for a year.

(i) What is a placebo?

.....

(1)

(ii) Why is a placebo group used in drug trials?

.....

.....

(1)

(iii) Which people knew what was in each tablet, in this trial?

Tick (✓) **one** box.

Both doctors and volunteers ☐

Doctors but not volunteers ☐

Neither doctors nor volunteers ☐

(1)

(iv) It is important that the three groups of volunteers should be similar.

Give **two** factors that should be similar in the groups of volunteers.

1 .....

2 .....

(2)

(c) The table shows the results of the trials.

Tablet	**Percentage of volunteers who had stopped smoking**	
	After 12 weeks	**After 1 year**
Drug **A**	44	23
Drug **B**	30	15
Placebo	18	10

A doctor looked at the results of the tests.

The doctor suggested that a smoker who wanted to give up smoking should use Drug **A**.

Why?

.....

.....

(1)
(Total 8 marks)

21

The concentration of cholesterol in the blood affects people's health.

(a) Give **two** factors that affect the concentration of cholesterol in the blood.

1 .....

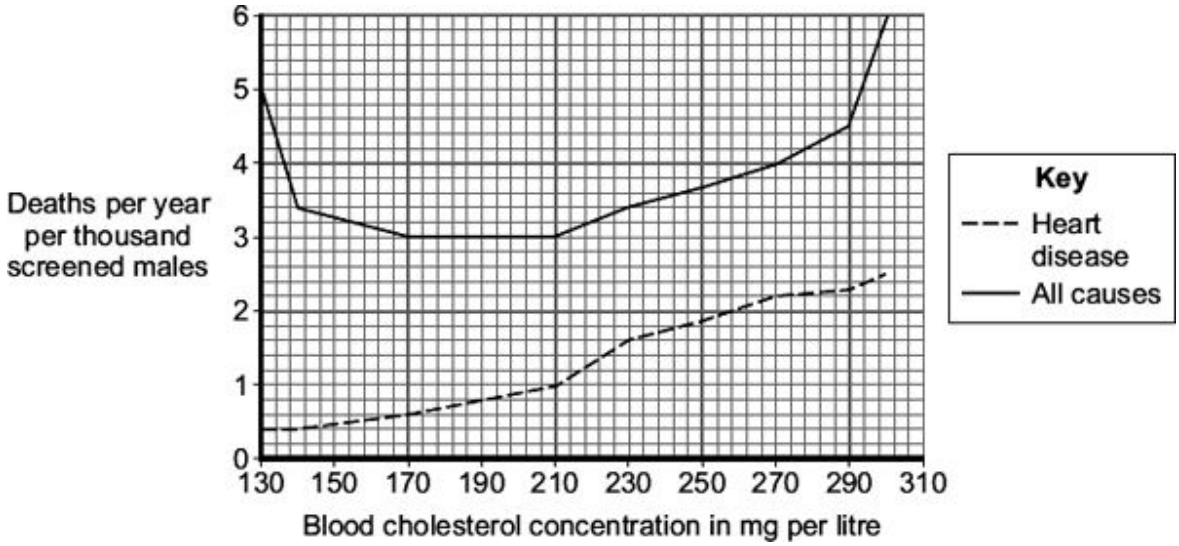
2 .....

(2)

(b) Doctors screened men for blood cholesterol concentration.

The doctors then compared death rates from heart disease with deaths from all causes in this screened group.

The graph shows the results.



(i) Which is the best conclusion that can be drawn from the data?

Tick (✓) **one** box.

There is a positive correlation between blood cholesterol concentration and deaths from all causes. ☐

There is a negative correlation between blood cholesterol concentration and deaths from all causes. ☐

Blood cholesterol concentration is only one of several factors affecting death from all causes. ☐

(1)

(ii) Based on the data in the graph **only**, which is the ideal range for blood cholesterol concentration?

Range ..... to..... mg cholesterol per litre.

(1)

(Total 4 marks)

22 Fruit is crushed to release fruit juice.

More juice can be collected if the plant cell walls in the fruit are broken down.

Some students tested the effect on the volume of fruit juice that they could collect of:

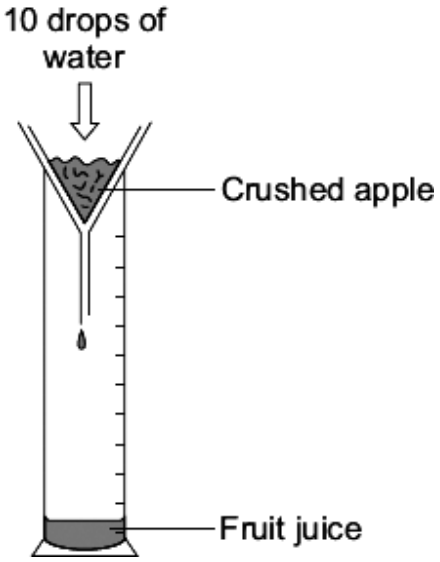
- **either** boiling the fruit
- **or** adding the enzyme pectinase to the fruit
- **or** adding the enzyme amylase to the fruit.

In their first experiment the students:

- crushed 20 g of apple
- added 10 drops of water
- measured the volume of fruit juice that they collected.

Diagram 1 shows how they collected the fruit juice.

Diagram 1



The students did three more experiments.

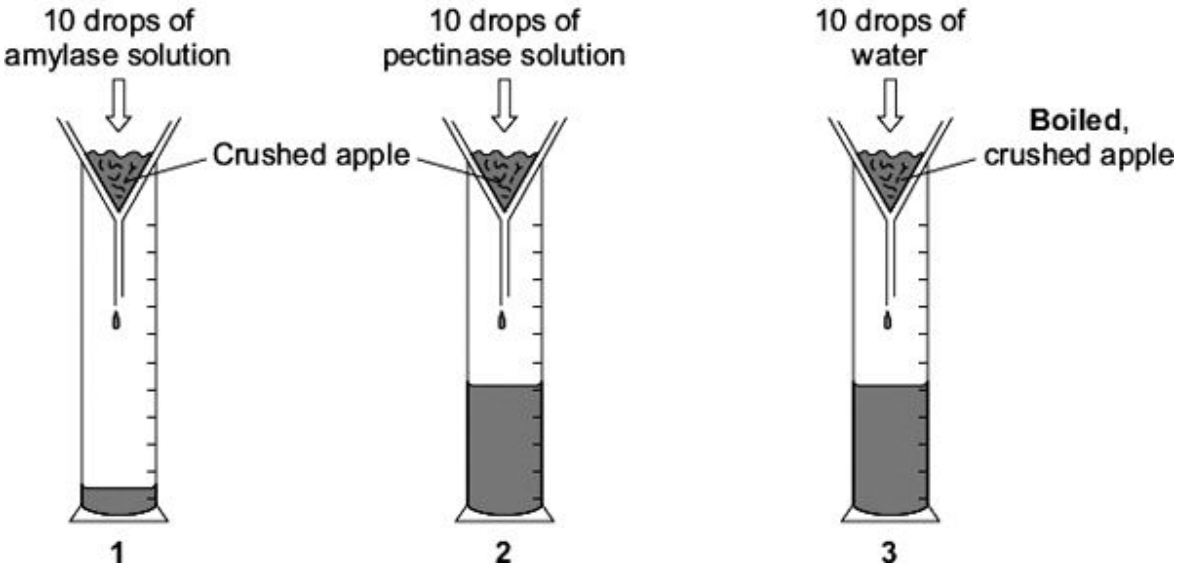
1 They added 10 drops of amylase solution to 20 g of crushed apple.

2 They added 10 drops of pectinase solution to 20 g of crushed apple.

3 They added 10 drops of water to 20 g of **boiled**, crushed apple.

Diagram 2 shows these experiments.

Diagram 2



(a) Give **one** control variable in this investigation.

.....

(1)

(b) Using drops to measure the volume of water and enzyme added might lead to inaccurate results.

Give **one** reason why.

.....

(1)

(c) The students' results are shown in the table.

What was added to the crushed apple	Was the apple boiled?	Volume of juice collected in cm^3
10 drops of water	No	1.2
10 drops of amylase solution	No	1.2
10 drops of pectinase solution	No	11.3
10 drops of water	Yes	11.6

Explain as fully as you can the students' results shown in the table.

Use all the information given to help you answer this question.

.....

.....

.....

.....

.....

.....

(3)

(d) One student said:

'If we add 10 drops of pectinase solution to crushed apple *while it is boiling*, we should collect more juice than if we add 10 drops of water to boiled apple.'

This is **not** correct.

What volume of juice would you predict the students would collect if 10 drops of pectinase solution were added to crushed apple *while it was boiling*?

Draw a ring around **one** answer.

1.2 cm^3 **11.3 cm^3** **11.6 cm^3** **22.9 cm^3**

(1)

Explain your answer.

.....

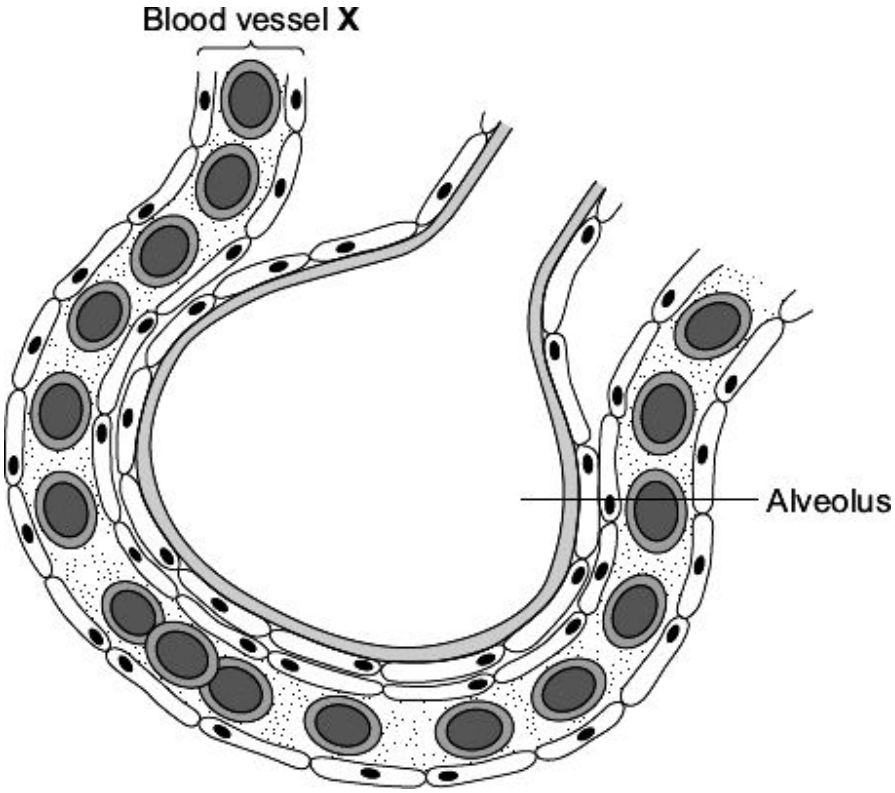
.....

.....

.....

(2)
(Total 8 marks)

23 The diagram shows an alveolus and a blood vessel in the lung.



(a) Draw a ring around the correct answer to complete each sentence.

(i) Blood vessel **X** is

an artery.
a capillary.
a vein.

(1)

(ii) Gases pass across the wall of the alveolus by

diffusion.
evaporation.
fermentation.

(1)

(iii) The table compares the concentrations of some gases in inhaled air and exhaled air.

Complete the table.
Write 'lower' **or** 'higher' in each box.
One line has been completed for you as an example.

Gas	**Concentration**	
	Inhaled air	**Exhaled air**
Water vapour	lower	higher
Carbon dioxide		
Oxygen		

(2)

(b) Draw a ring around the correct answer to complete each sentence.

(i) Oxygen is carried in the blood mainly in

blood plasma.
red blood cells.
white blood cells.

(1)

(ii) In the blood, the oxygen combines with

carbon dioxide.
haemoglobin.
urea.

(1)
(Total 6 marks)

24 Plants lose water vapour from their leaves. Most of this water vapour is lost through the stomata.

(a) Draw a ring around the correct answer to complete the sentence.

Plants lose water vapour by

distillation.
filtration.
transpiration.

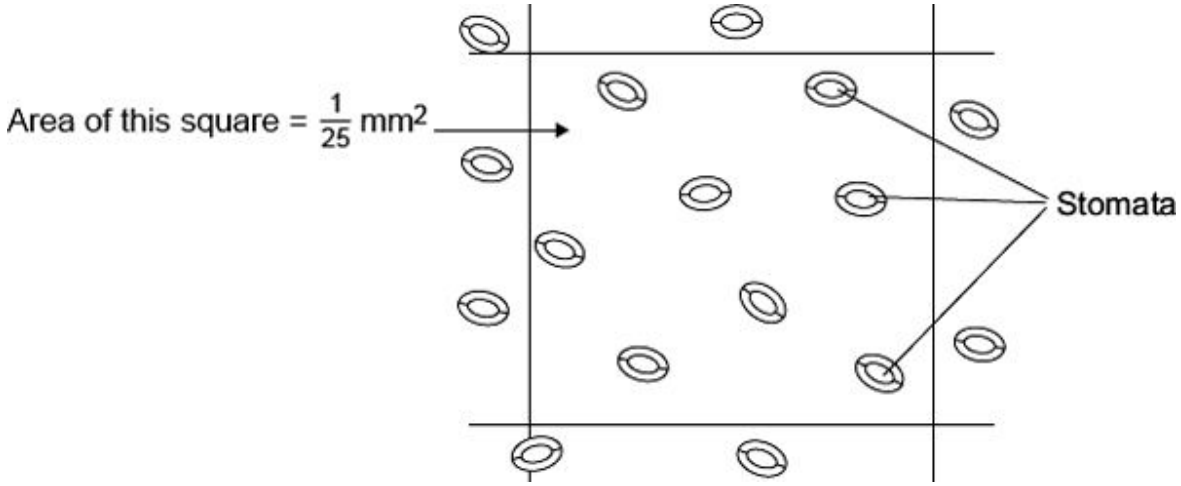
(1)

(b) A class of students investigated the number of stomata per mm^2 on the upper surface and on the lower surface of the leaves of three species of plant, **P**, **Q** and **R**.

The students placed samples of the surface cells onto a grid on a microscope.

Student **X** counted the stomata on the lower surface of a leaf from one of the plant species.

The diagram shows part of the grid that student **X** saw under the microscope.



(i) Complete the calculation to estimate the number of stomata per mm^2 on the lower surface of this leaf.

Number of stomata in $\frac{1}{25}$ mm^2 = ...

Number of stomata in 1 mm^2 = ...

(2)

The table shows the mean results for the class.

Plant species	Mean number of stomata per mm^2 of leaf	
	Upper surface of leaf	Lower surface of leaf
P	40	304
Q	0	11
R	85	195

(ii) Student **X** had counted the stomata on the lower surface of a leaf from one of the plant species.

Use your answer to part **(b)(i)**, and information in the table, to help you to answer this question.

From which plant species, **P**, **Q** or **R**, was student **X**'s leaf most likely to have been taken? ☐

(1)

(iii) Species **Q** is normally found growing in hot, dry conditions.

Explain **one** way in which species **Q** is adapted for living in hot, dry conditions.

Use information from the table.

.....

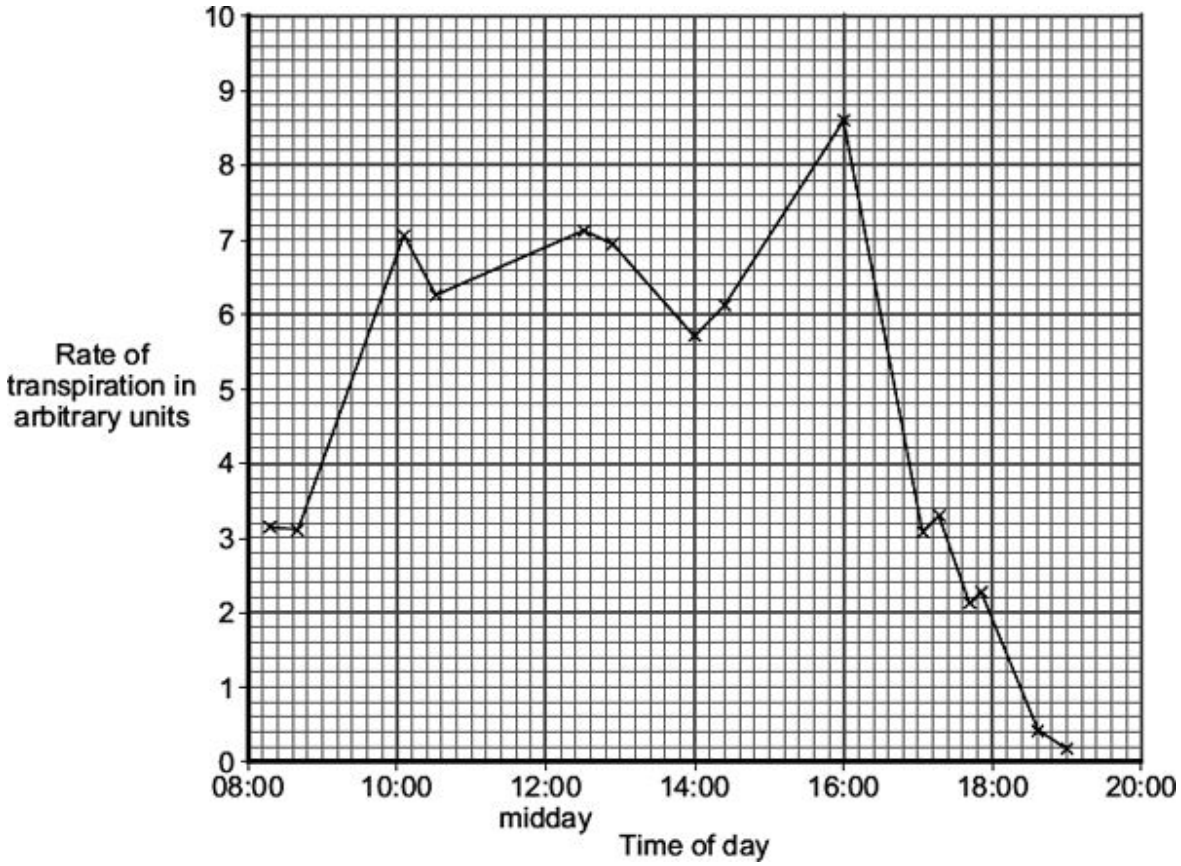
.....

.....

.....

(2)
(Total 6 marks)

25 The graph shows the rate of transpiration from a plant at different times of the day.



Transpiration occurs mainly in the leaves of a plant.

(a) (i) What is *transpiration*?

.....

.....

.....

.....

(2)

(ii) Through which part of a leaf does most transpiration occur?

.....

(1)

(b) In this investigation, the rate of transpiration decreases between 16:00 hours and 19:00 hours.

(i) Calculate the average rate of decrease per hour in the rate of transpiration over this time.

Show clearly how you work out your answer.

.....

.....

.....

.....

Rate = ... arbitrary units per hour

(2)

(ii) Suggest **one** explanation for the decrease in the rate of transpiration between 16:00 hours and 19:00 hours.

.....

.....

.....

.....

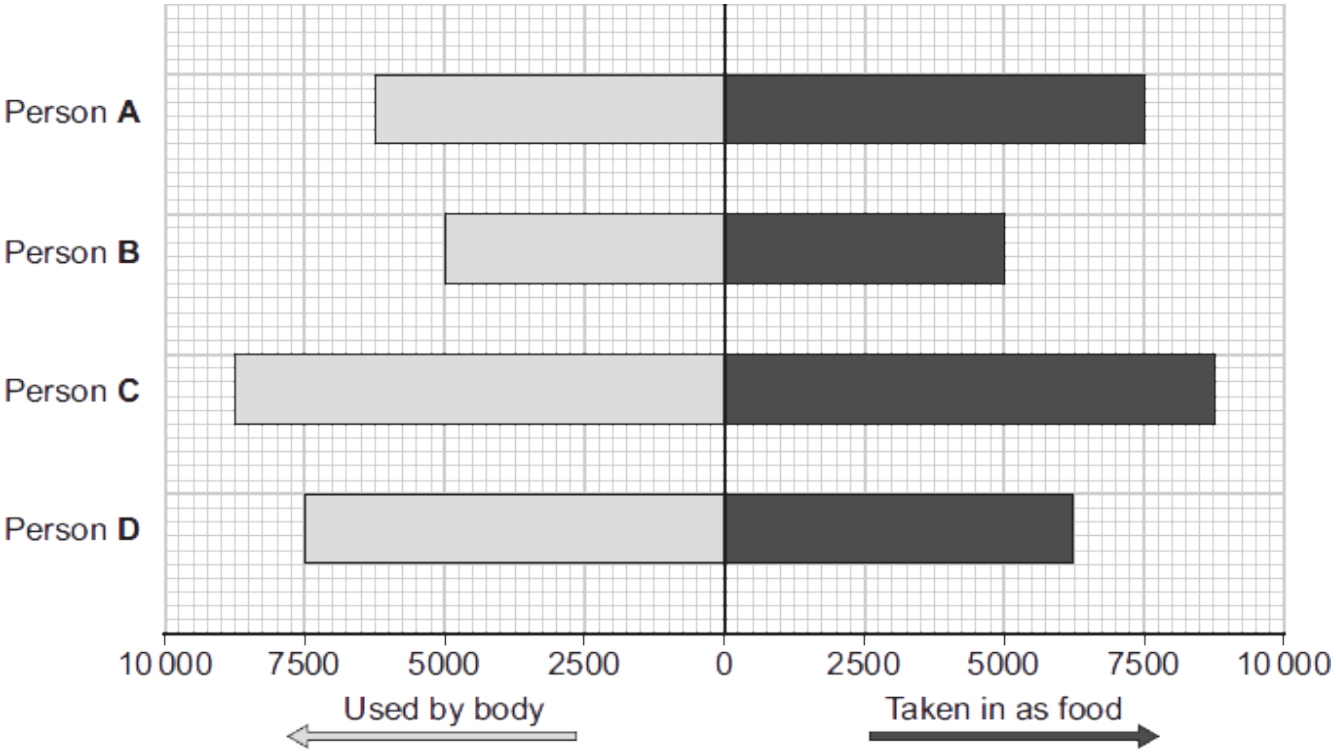
(2)

(Total 7 marks)

26 Scientists measured the amount of energy used by four people, **A**, **B**, **C** and **D**.

The scientists also measured the amount of energy taken in as food by each person.

The chart shows the scientists' results.



Mean energy in kJ per day

(a) (i) What was the mean amount of energy used by **D**?

..... kJ per day

(1)

(ii) The amount of energy used by **D** is different from the amounts of energy used by **A**, **B** and **C**.

Suggest **two** reasons why.

.....

.....

.....

.....

(2)

(b) The data in the bar chart was collected over twelve months.

Which person, **A**, **B**, **C** or **D**, would gain body mass over the twelve months?

Give a reason for your answer.

.....

.....

.....

.....

(2)

(c) In the UK many people are obese.
Doctors advise obese people to lose mass.

Suggest **two** different ways an obese person could lose mass.

.....

.....

.....

.....

(2)
(Total 7 marks)

27 Thalidomide is a drug that was developed in the 1950s.
In the 1950s some pregnant women took thalidomide to prevent morning sickness during pregnancy.

Today, thalidomide is **not** used to prevent morning sickness.

(a) (i) Give **one** medical use of thalidomide, today.

.....

.....

(1)

(ii) Today, before a woman is given thalidomide, she is

- checked to see if she is pregnant
- told to use two different methods of contraception at the same time.

Give the reason why:

the woman is checked to see if she is pregnant

.....

.....

the woman is told to use two different methods of contraception at the same time

.....

.....

(2)

(b) The information is about two types of contraceptive pill used by women.

Combined pill

- contains two hormones
- is taken for 21 days, then no pills are taken for 7 days
- > 99 % effective at preventing pregnancy
- increases chance of headaches
- increases chance of breast cancer
- decreases chance of cancer of the ovary

Mini-pill

- contains one hormone
- must be taken at the same time every day
- < 99 % effective at preventing pregnancy
- increases chance of breast cancer

(i) Which **two** hormones does the combined pill contain?

Draw a ring around **two** answers.

LH **oestrogen** **progesterone** **FSH**

(2)

(ii) Give **two** advantages of taking the combined pill and **not** the mini-pill.

.....

.....

.....

.....

(2)

(iii) Give **one** advantage of taking the mini-pill and **not** the combined pill.

.....

.....

(1)
(Total 8 marks)

28 Scientists at a drug company developed a new pain-killing drug, drug **X**.

(a) Painkillers do **not** cure infectious diseases.

Why?

.....

(1)

(b) The scientists compared drug **X** with two other pain-killing drugs, drug **A** and drug **B**.
In their investigation the scientists:

- chose 600 volunteers. The volunteers were all in pain
- gave 200 of the volunteers a standard dose of drug **A**
- gave 200 of the volunteers a standard dose of drug **B**
- gave 200 of the volunteers a standard dose of drug **X**.

Over the next seven hours the volunteers recorded how much pain they felt.

To get valid results the three groups of volunteers should be matched for as many factors as possible.

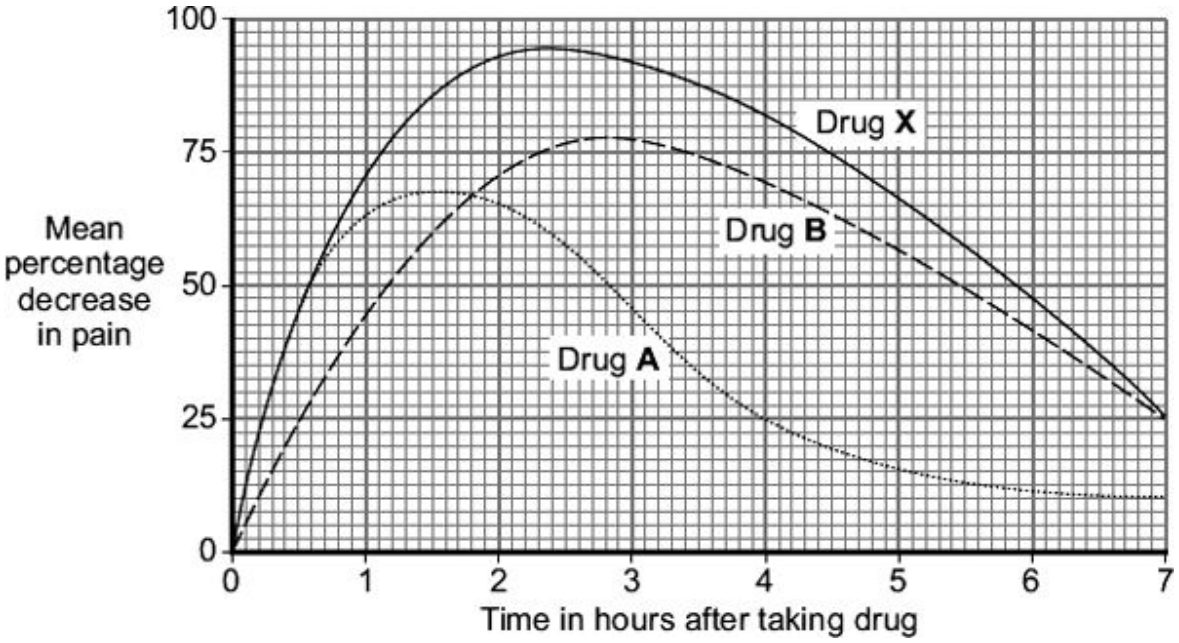
Suggest **two** of the factors that should be matched.

.....

.....

(2)

(c) The graph shows the results of the investigation.



(i) How much pain did the volunteers still feel, four hours after taking drug **A**?

..... percent

(1)

(ii) Give **one** advantage of taking drug **A** and **not** drug **B**.

.....

.....

(1)

(iii) Give **two** advantages of taking drug **B** and **not** drug **A**.

.....

.....

.....

.....

(2)

(d) Drug **X** is much more expensive than both drug **A** and drug **B**.

A pharmacist advised a customer that it would be just as good to take drug **A** and drug **B** together instead of drug **X**.

Do you agree with the pharmacist's advice?

Give reasons for your answer.

.....

.....

.....

.....

.....

.....

.....

(3)
(Total 10 marks)

29 In a living organism, the cells are organised into organs, systems and tissues.

(a) Use words from the box to complete the list of these structures in order of size.

organs	**systems**	**tissues**

The smallest structure is at the top of the list and the largest is at the bottom.

1 **cells**

2 .....

3 .....

4 .....

5 **organism**

(smallest)

(largest)

(1)

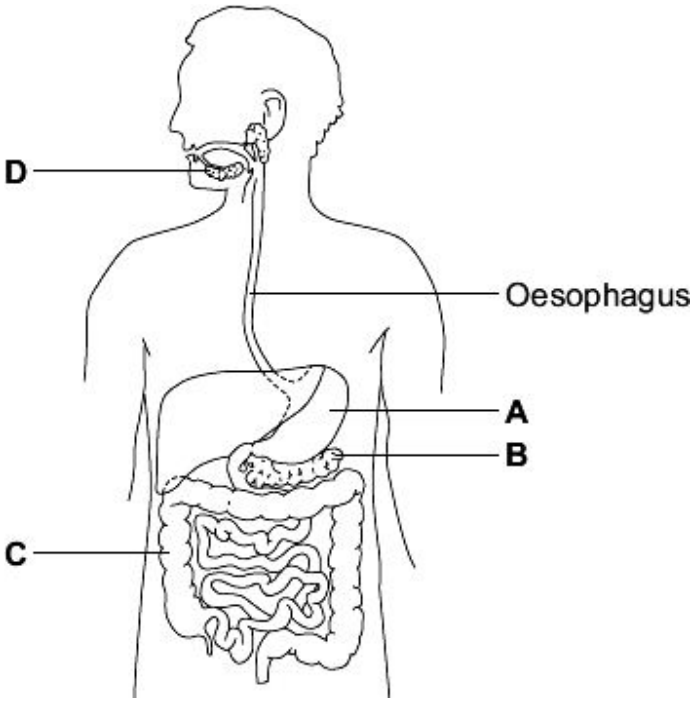
(b) **List A** gives three tissues found in the human body.
List B gives four functions of tissues.

Draw a straight line from each tissue in **List A** to its correct function in **List B**.

List A – Tissue	**List B – Function**
	Covers many parts of the body
Muscular tissue	
	Contracts to cause movement
Glandular tissue	
	Divides by meiosis
Epithelial tissue	
	Releases hormones or enzymes

(3)
(Total 4 marks)

30 The diagram shows the human digestive system.



(a) *Heartburn* is a burning feeling caused when acid enters the oesophagus. The acid comes from the stomach.

(i) Which letter on the diagram shows the stomach? ☐

(1)

(ii) Name the acid the stomach produces.

.....

(1)

(iii) Medicines taken to treat *heartburn* contain chemicals that neutralise excess stomach acid.

What type of chemical will neutralise stomach acid?

.....

(1)

(b) Use words from the box and your own knowledge to describe how carbohydrates are digested.

amylase	starch	sugars

.....

.....

.....

.....

.....

.....

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.....

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.....

.....

(5)

(c) Where in the body are the products of digestion absorbed?

.....

(1)
(Total 9 marks)

31 (a) Complete the equation for photosynthesis.

..... + ... $\xrightarrow{\text{light energy}}$ ..... + oxygen

(2)

(b) Scientists investigated how temperature affects the rate of photosynthesis.
The scientists grew some orange trees in a greenhouse.
They used discs cut from the leaves of the young orange trees.

The scientists used the rate of oxygen production by the leaf discs to show the rate of photosynthesis.

(i) The leaf discs did not produce any oxygen in the dark.

Why?

.....

.....

(1)

(ii) The leaf discs took in oxygen in the dark.

Explain why.

.....

.....

.....

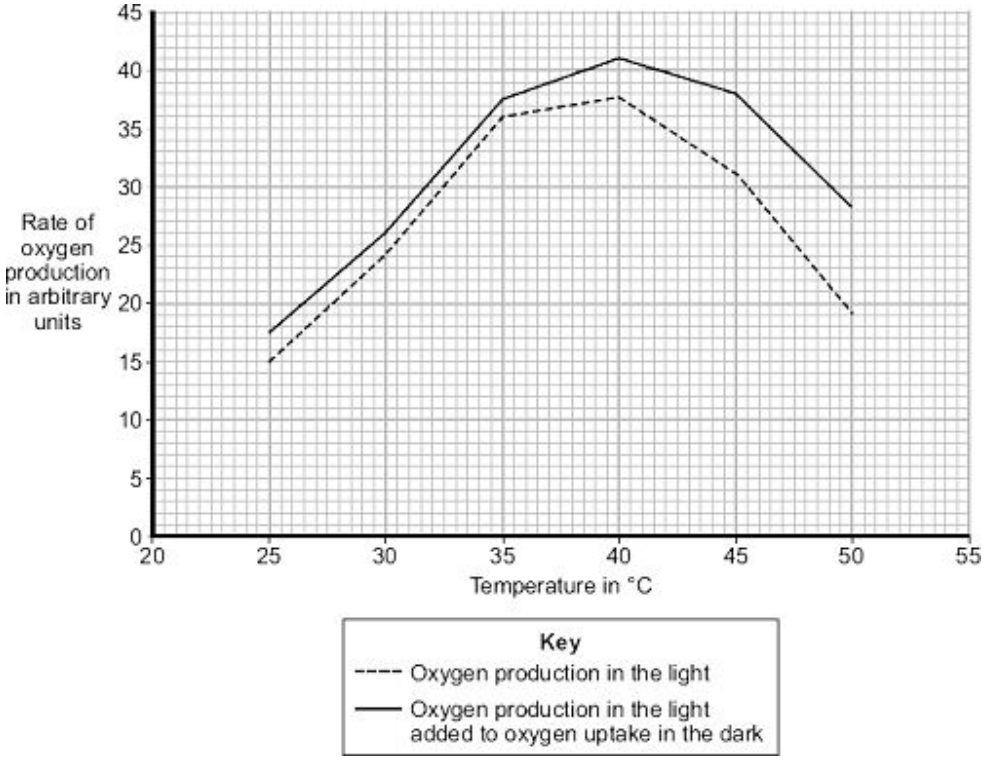
.....

(2)

(c) In their investigation, the scientists measured the rate of oxygen release by the leaf discs in the light. The scientists then measured the rate of oxygen uptake by the leaf discs in the dark.

The graph shows the effect of temperature on

- oxygen production in the light
- oxygen production in the light added to oxygen uptake in the dark.



Use the information from the graph to answer each of the following questions.

(i) Describe the effect of temperature on oxygen production in the light.

.....

.....

.....

.....

(2)

(ii) Explain the effect of temperature on oxygen production in the light when the temperature is increased:

from 25 °C to 35 °C

.....

.....

.....

from 40 °C to 50 °C.

.....

.....

.....

(2)

(d) A farmer in the UK wants to grow orange trees in a greenhouse. He wants to sell the oranges he produces at a local market.
He decides to heat the greenhouse to 35 °C.

Explain why he should **not** heat the greenhouse to a temperature higher than 35 °C.
Use information from the graph in your answer.

.....

.....

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.....

.....

(3)
(Total 12 marks)

32 Obesity is linked to several diseases.

(a) Name **two** diseases linked to obesity.

1 .....

2 .....

(2)

(b) Scientists trialled a new slimming drug.

The table shows their results after one year.

Percentage change in mass of each volunteer	Number of volunteers
gained mass or lost 0 to 3.9 %	1900
lost 4.0 to 4.9 %	1100
lost 5.0 to 9.9 %	1500
lost 10 % or more	1500

(i) Calculate the proportion of the volunteers who lost 10 % or more of their mass.

You should first calculate the total number of volunteers, then work out the proportion.

.....

.....

Proportion of volunteers = ...

(2)

(ii) The National Health Service (NHS) gave permission for the drug to be used.

Use information from the table to suggest a reason why the NHS gave permission for the drug to be used.

.....

.....

(1)

(Total 5 marks)

33 The table shows the mass of carbon dioxide passed into the atmosphere in one year.

	Mass of carbon dioxide passed into the atmosphere in billions of tonnes per year
Animals	45
Plants	15
Microorganisms	60
Human activity	9

(a) (i) Calculate the total mass of carbon dioxide passed into the atmosphere in one year.

.....

.....

Answer = ... billion tonnes

(1)

(ii) Plants take 120 billion tonnes of carbon dioxide out of the atmosphere per year.

Use your answer to part (a)(i) to calculate the change in the mass of carbon dioxide in the atmosphere in one year.

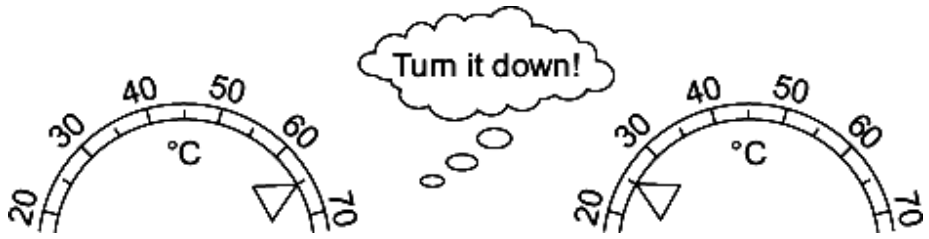
.....

.....

Answer = ... billion tonnes

(1)

(b) The drawing shows part of a campaign to encourage householders to reduce the temperature of the water used to wash clothes.



Give **two** advantages to the environment of reducing the temperature of the water used to wash clothes.

1 .....

.....

2 .....

.....

(2)

(c) A householder reduces the temperature of the water he uses to wash clothes.
He finds that some stains are not removed at the new temperature.
He decides to use a biological washing powder.
Biological washing powders contain enzymes.

(i) Draw a line from each enzyme in **List 1** to the type of stain the enzyme will remove, in **List 2**.

List 1 **Enzyme**	**List 2** **Type of Stain**
	Starch
Protease	
	Fat
Lipase	
	Protein

(2)

(ii) The biological washing powder would **not** have removed the stains from clothes if the water had been at 65 °C.

Use **one** word from the box to complete the sentence.

killed	**denatured**	**diffused**

At 65 °C the enzymes would be .....

(1)

(Total 7 marks)

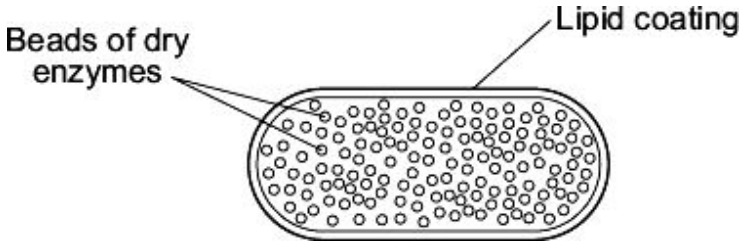
34 A patient has a disease. The disease damages his pancreas.

A doctor prescribes a course of treatment for the patient:
'Take one capsule with each meal.'

Each capsule contains hundreds of small, dry beads.

The beads are made of enzymes. The pancreas normally produces these enzymes.

The outer coating of the capsule is made of lipid.



(a) One enzyme in the beads is lipase.

In a healthy person, lipase is made in the pancreas.

Name **two** other enzymes made in the pancreas of a healthy person.

1 .....

2 .....

(2)

(b) The lipid coating on the capsule makes sure that the enzymes are not released until the capsule reaches the small intestine.

Explain how.

.....

.....

.....

.....

.....

(2)

(c) The lipase in the beads does **not** digest the lipid coating around the capsule.

Suggest why.

.....

.....

(1)
(Total 5 marks)

35 (a) **List A** gives four structures in the human body.

List B gives the functions of some structures in the body.

Draw a straight line from each structure in **List A** to the correct function in **List B**.

List A – Structure	**List B – Function**
	Surround and protect the lungs
Alveoli	
	Filter the blood
Veins	
	Carry blood towards the heart
Villi	
	Absorb digested food
Ribs	
	Allow oxygen to enter the blood

(4)

(b) Draw a ring around the correct answer to complete the sentence.

In the lungs, oxygen enters the blood from the air by

diffusion.

filtration.

respiration.

(1)

(Total 5 marks)

36 (a) Draw a ring around the correct answer to complete the sentence.

A plant loses water from its leaves by a process called

distillation.

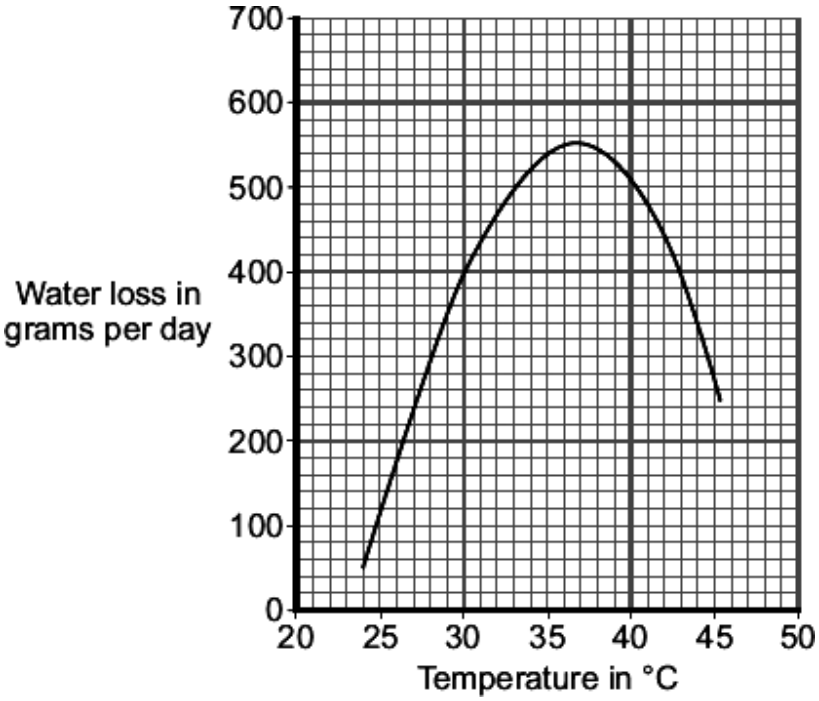
respiration.

transpiration.

(1)

(b) Some scientists investigated the effect of temperature on water loss from a plant.

The graph shows the results.



Describe the effect of increasing the temperature on water loss from the plant.

.....

.....

.....

.....

(2)

(c) Under different conditions, plants open or close their stomata.

(i) How does closing its stomata help a plant?

.....

.....

(1)

(ii) In the investigation described in part (b), which temperature range would cause most of the stomata to close?

Draw a ring around **one** answer.

25 - 30 °C **30 - 35 °C** **40 - 45 °C**

(1)
(Total 5 marks)

37 Scientists estimate that about one third of cancers in the UK may be linked to obesity.

Name **two** diseases linked to obesity.

Do **not** give cancer as one of your answers.

1 .....

2 .....

(Total 2 marks)

38 Denim jeans can be coloured with blue dye. The dye joins on to the fibres of the material. Some people like their denim jeans to look faded. This is called 'stonewashed'. There are two different ways to make denim material look faded.

Traditional stone washing

- Denim material is put in a slowly spinning container with large stones.
- Very hot water is added.
- Washing takes up to five hours.
- Washing breaks some of the denim fibres and lets the dye come out from the fibres.
- Washing will work with any dye.

Bio-stonewashing

- Denim material is washed with enzymes in warm water.
- Washing takes half an hour.
- The enzymes let the dye come out from the fibres.
- Different enzymes are needed for different dyes.
- The enzymes are expensive.
- After the treatment the enzymes have to be removed from the denim.

(a) Use **only** the information above to answer this question.

(i) Suggest **two advantages** of using the bio-stonewashing method instead of the traditional stonewashing method.

1 .....

.....

2 .....

.....

(2)

(ii) Suggest **two disadvantages** of using the bio-stonewashing method instead of the traditional stonewashing method.

1 .....

.....

2 .....

.....

(2)

(b) Some blue dyes are made of protein.

What type of enzyme would be used to remove these blue dyes from denim?

Draw a ring around **one** answer.

carbohydrase **lipase** **protease**

(1)
(Total 5 marks)

39 There are enzymes in biological washing powders. Biological washing powder has to be used at temperatures below 45 °C.

(a) The enzymes in biological washing powders do **not** work on the stains on clothes at temperatures above 45 °C.

Explain why.

.....

.....

.....

.....

(2)

(b) Some bacteria, called thermophilic bacteria live in hot springs at temperatures of 80 °C.

Scientists have extracted enzymes from these thermophilic bacteria. These enzymes are being trialled in industrial laundries.
The laundries expect to increase the amount of clothes they can clean by using enzymes from thermophilic bacteria instead of using the biological washing powders the laundries use now.

(i) The laundries expect to be able to increase the amount of clothes that they can clean each day.

Suggest why.

.....

.....

.....

.....

.....

(2)

(ii) Using washing powders with enzymes from thermophilic bacteria may be more harmful to the environment than using the biological washing powders that laundries use now.

Suggest why.

.....

.....

.....

.....

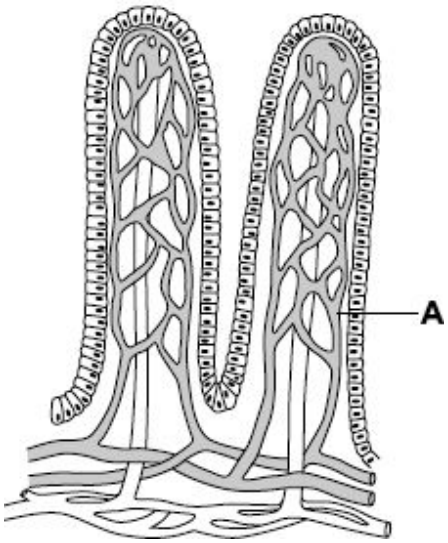
.....

(2)
(Total 6 marks)

40 Villi are found in some parts of the digestive system.

Diagram 1 shows two villi.

Diagram 1



(a) Draw a ring around the correct answer to complete each sentence.

(i) Structure **A** is a

muscle.
nerve.
capillary.

(1)

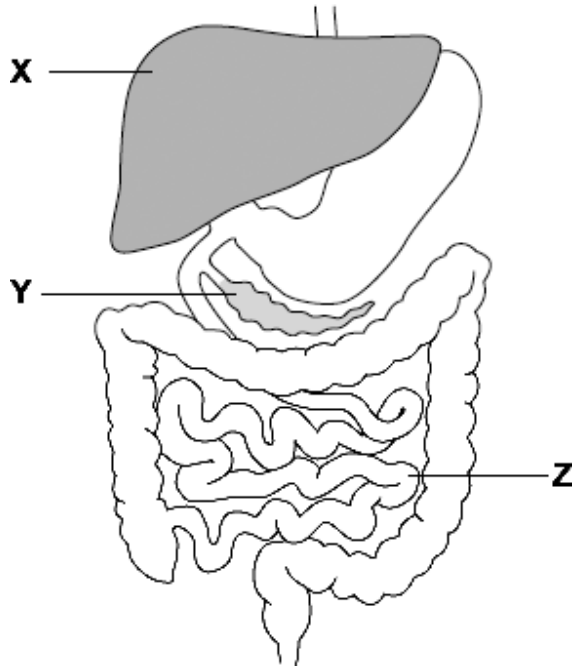
(ii) The villi absorb the products of digestion by

dialysis.
diffusion.
osmosis.

(1)

(b) **Diagram 2** shows the digestive system.

Diagram 2



(i) In which part of the digestive system, **X**, **Y** or **Z**, are most villi found?

(1)

(ii) There are about 2000 villi in each cm^2 of this part of the digestive system.

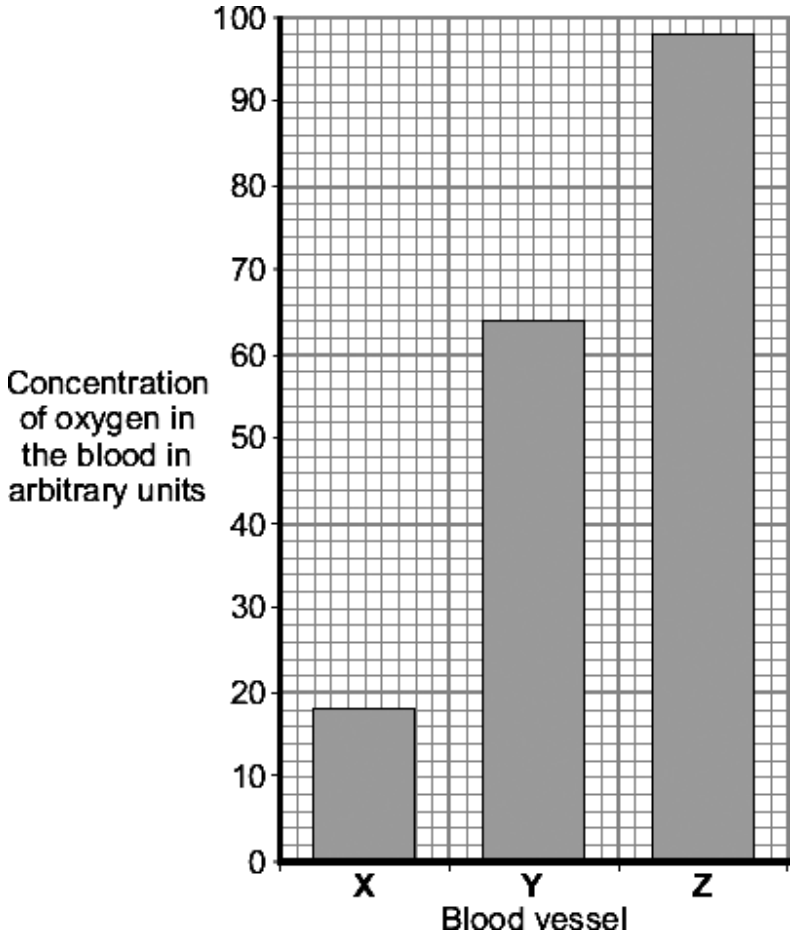
Why is it helpful to have lots of villi?

.....

.....

(1)
(Total 4 marks)

41 The bar chart shows the concentration of oxygen in the blood in three different blood vessels, **X**, **Y** and **Z**.



(a) (i) What is the concentration of oxygen in blood vessel **X**?

Answer ..... arbitrary units.

(1)

(ii) Which blood vessel, **X**, **Y** or **Z**, carries blood from the lungs to the heart? ☐

(1)

(b) Draw a ring around the correct answer to complete each sentence.

(i) Most of the oxygen in the blood is carried by the

plasma.

red blood cells.

white blood cells.

(1)

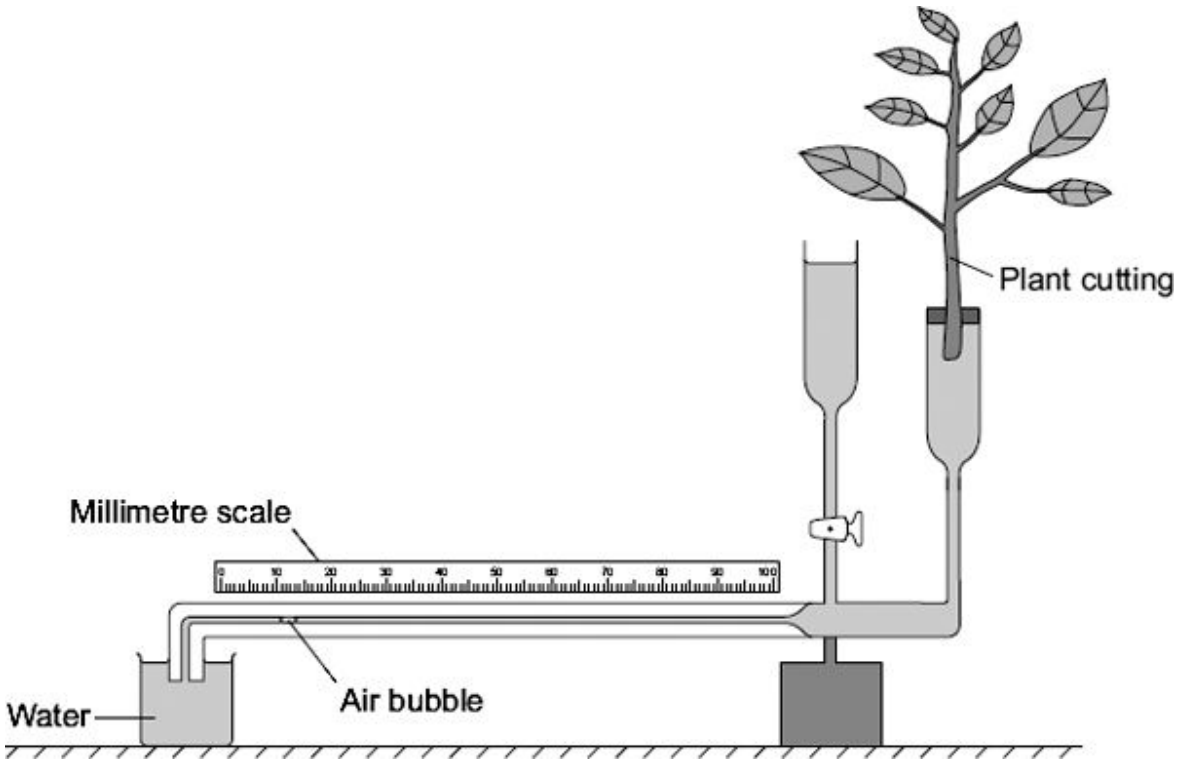
(ii) Oxygen combines with a coloured pigment in the blood.

This coloured pigment is called

alveoli.
haemoglobin.
lactic acid.

(1)
(Total 4 marks)

42 Some students used the apparatus shown in the diagram to measure the rate of water uptake by a plant cutting.



The students set up the apparatus in three different conditions:

- no wind at 15 °C
- no wind at 25 °C
- wind at 25 °C

For each experiment, the students recorded the movement of the air bubble along the scale.

(a) (i) Name the **two** variables that the students chose to change in these experiments.

1 .....

2 .....

(2)

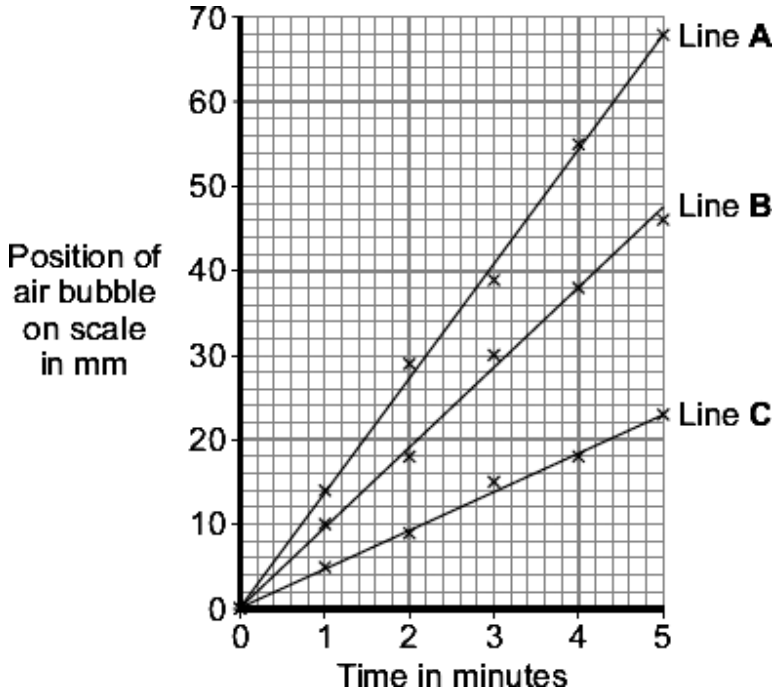
(ii) It was important to use the same plant cutting each time to make these experiments fair.

Explain why.

.....

(1)

(b) The graph shows the students' results.



Which line on the graph, **A**, **B** or **C**, shows the results for each of the three different experiments?

Write each of the letters **A**, **B** or **C** in the correct boxes in the table.

Condition	Letter
No wind at 15 °C	
No wind at 25 °C	
Wind at 25 °C	

(2)

(c) Water is lost from the leaves of the plant cutting.

Name this process.

Draw a ring around **one** answer.

distillation **respiration** **transpiration**

(1)

(Total 6 marks)

43 The table shows the volume of blood flowing through different organs at three levels of exercise.

Organ(s)	Volume of blood flowing through organ(s) in cm^3 per minute		
	Light exercise	**Moderate exercise**	**Heavy exercise**
Gut	1 100	600	300
Kidneys	900	600	250
Brain	750	750	750
Heart muscles	350	750	1 000
Skeletal muscles	4 500	12 500	22 000
Skin	1 500	1 900	600
Other	400	500	100
Total	**9 500**	**17 600**	**25 000**

(a) (i) Which organ has a constant flow of blood through it?

.....

(1)

(ii) Which organ has the greatest reduction in the volume of blood supplied during heavy exercise compared with light exercise?

.....

(1)

(iii) What proportion of the blood flows through the heart muscle during heavy exercise?

.....

(1)

(b) The volume of blood flowing through the skeletal muscles increases greatly during exercise.

Give **two** ways in which the body brings about this increase.

1 .....

.....

2 .....

.....

(2)

(c) During exercise, the concentration of carbon dioxide in the blood increases.

Explain what causes this increase.

.....

.....

.....

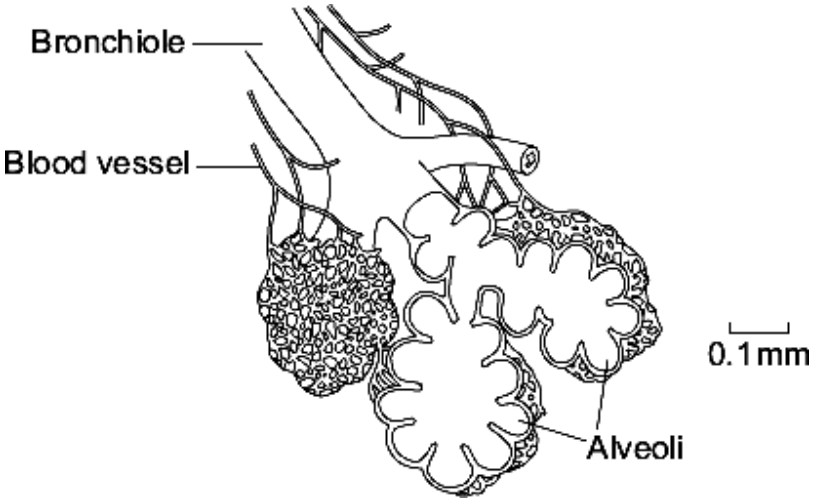
.....

.....

.....

(3)
(Total 8 marks)

44 The human lung has about 80 million alveoli.
The diagram shows some alveoli in a human lung.



(a) Give **three** features of the alveoli that allow large amounts of oxygen to enter the blood.

1 .....

.....

2 .....

.....

3 .....

.....

(3)

(b) (i) Name the process by which oxygen passes from the air into the blood.

.....

(1)

(ii) Breathing allows large amounts of oxygen to enter the blood.

Explain how breathing does this.

.....

.....

.....

.....

(2)
(Total 6 marks)

45 Scientists have trialled a new statin called rosuvastatin.

- 17 802 people took part in the trial.
- All of these people had high levels of a protein called CRP in their blood.
- The higher the level of CRP in the blood, the higher the risk of a heart attack.
- None of these people had heart conditions at the beginning of the investigation.
- None of these people had high LDL (low density lipoprotein) levels.
- All of these people were aged 50 or above.
- Half the people were given a rosuvastatin tablet each day; the other half were given a placebo.
- The trial was stopped 7 months early when it was found that the people given rosuvastatin were 54% less likely to have a heart attack than people given the placebo.

(a) Give **two** control variables in this investigation.

1 .....

2 .....

(2)

(b) What would the placebo be in this investigation?

.....

.....

(1)

(c) The trial gave reliable results.

Give **one** reason why.

.....

.....

(1)

(d) The trial was stopped 7 months early.

Give **one** reason why.

.....

.....

(1)

(e) The manufacturers of rosuvastatin paid for the trial.

However, the manufacturers took no part in the trial.

Suggest **one** reason why the manufacturers did not take part in the trial.

.....

.....

(1)

(f) The table shows some of the results of the trial.

Substance	**Concentration in blood in mg per 100 cm^3 after 3 years of trial**	
	People given rosuvastatin	People given placebo
LDL cholesterol	53	106
HDL cholesterol	50	49
Saturated fats	106	123

Rosuvastatin reduces the risk of heart attacks.

Use the data in the table to explain why.

.....

.....

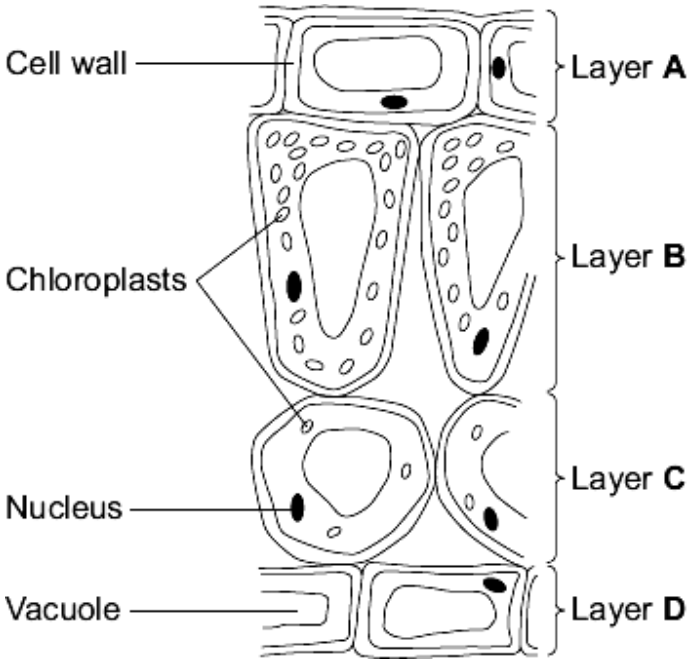
.....

.....

(2)
(Total 8 marks)

46 Leaves are made from layers of cells.

The diagram shows a section through part of a leaf.



(a) (i) Which word in the table describes layer **A**?

Tick (✓) **one** box.

Layer A	**Tick (✓)**
Tissue	
Organ	
Cell	

(1)

(ii) Which word describes a whole leaf?

Draw a ring around **one** answer.

organ **tissue** **organism**

(1)

(b) (i) Which **two** layers of cells, **A**, **B**, **C** and **D**, can photosynthesise?

Use information from the diagram to help you.

Tick (✓) **two** boxes.

Layer **A** ☐

Layer **B** ☐

Layer **C** ☐

Layer **D** ☐

(2)

(ii) Give **one** reason for your answer.

.....

.....

(1)

(c) List **X** gives the names of two parts of a cell.
List **Y** gives information about parts of a cell.

Draw **one** line between each part of the cell in list **X** and information about it in list **Y**.

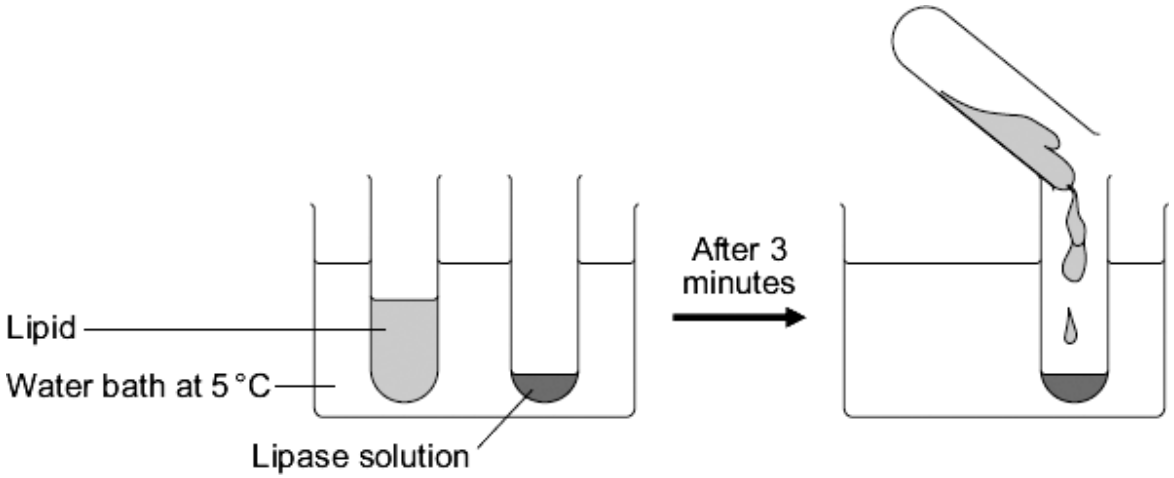
List X **Part of a cell**	**List Y** **Information**
Vacuole	Controls the passage of substances into the cell
Nucleus	Contains the cell sap
	Controls the activities of the whole cell

(2)
(Total 7 marks)

47 A group of students investigated the effect of temperature on the action of the enzyme lipase.

The students:

- put 1 cm^3 of lipase solution into a test tube
- put 5 cm^3 of lipid into a different test tube
- put both tubes in a water bath at 5 °C for 3 minutes
- mixed the lipid with the lipase solution.



Every five minutes the students tested a sample of the mixture for lipid, until no lipid remained. The students repeated the experiment at different temperatures.

(a) To make their investigation fair the students needed to control some variables.

Give **one** variable the students controlled in their investigation.

.....

(1)

(b) The tubes of lipase solution and lipid were kept separately in the water bath for 3 minutes before mixing. Why?

Tick (✓) **one** box.

So that the lipase broke down the lipid quickly ☐

So that the lipase and the lipid reached the right temperature ☐

To give enough time for the lipase to break down the lipid ☐

To give enough time for the water bath to heat up ☐

(1)

The table shows the students' results.

Temperature in °C	Time taken until no lipid remained in minutes
5	40
20	15
35	5
50	30
95	lipid still there after 120 minutes

(c) Describe the effect on the breakdown of the lipid of increasing the temperature from 5 °C to 50 °C.

.....

.....

.....

.....

(2)

(d) Suggest **two** ways in which the students could have improved their investigation.

Use information from the students' method and the results table to help you.

1 .....

.....

.....

2 .....

.....

.....

(2)

(e) (i) The lipase did **not** break down the lipid at 95 °C.

Why?

.....

.....

(1)

(ii) At 35 °C the lipase broke down the lipid after 5 minutes.

What new substances will be in the tube?

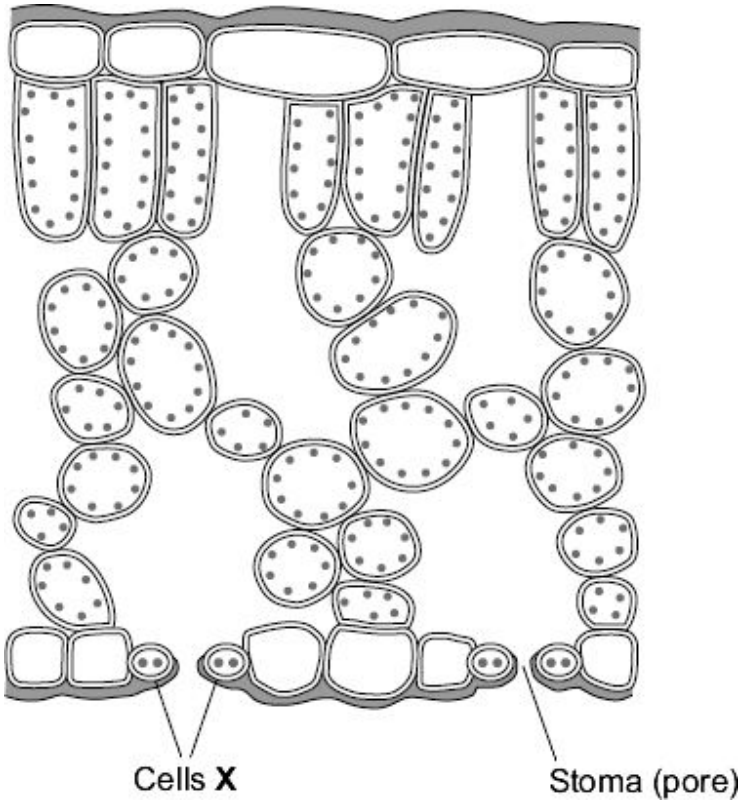
Draw a ring around **one** answer.

amino acids **fatty acids and glycerol** **sugars**

(1)

(Total 8 marks)

48 The diagram shows a section through a plant leaf.



(a) The cells labelled **X** surround a stoma (pore).

Draw a ring around the correct answer to complete the sentence.

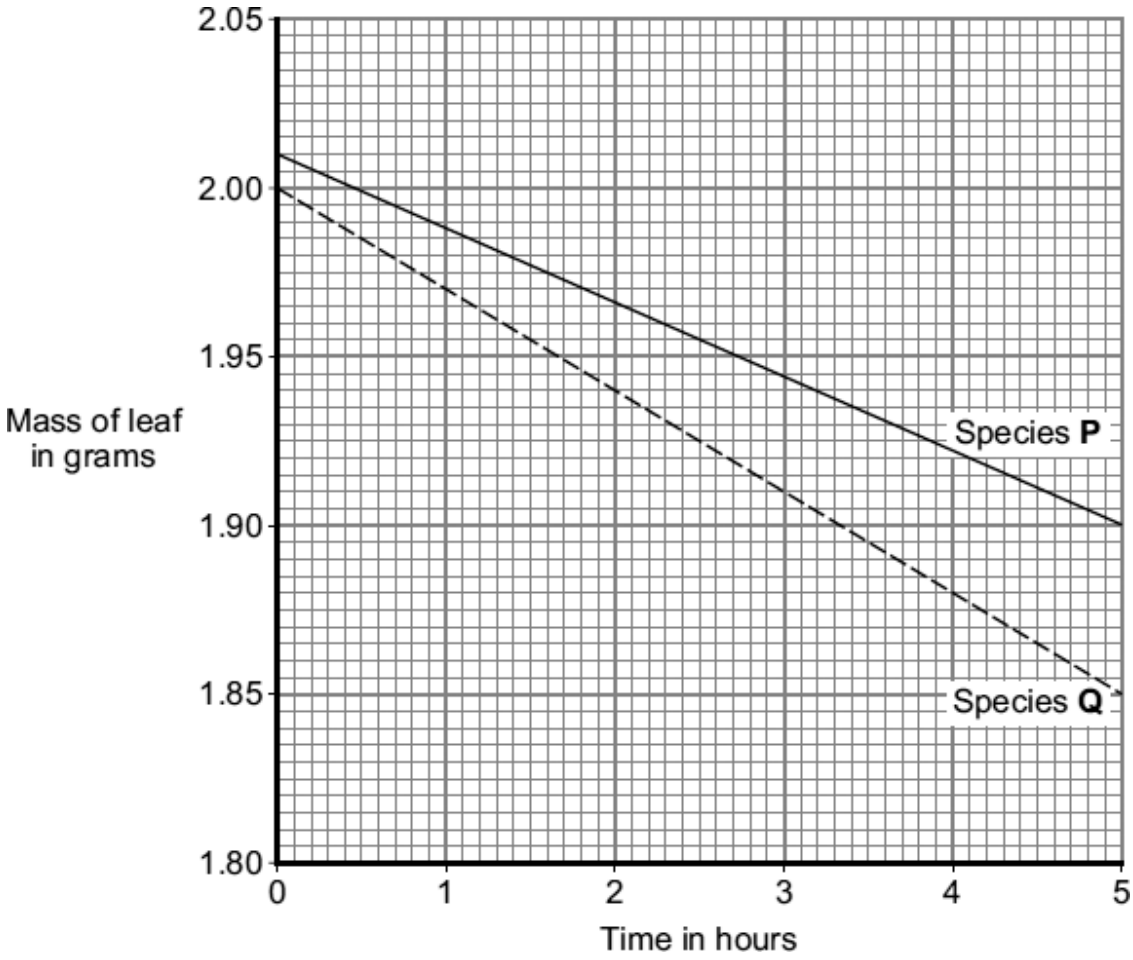
Cells **X** are called

- alveoli.
- guard cells.
- villi.

(1)

(b) Water vapour is lost from leaves. Water loss causes a leaf to lose mass.

The graph shows how the masses of leaves from two plant species, **P** and **Q**, changed over several hours. Both leaves were kept in the same conditions.



(i) What was the mass of the leaf of species **Q** at 0 hours?

..... grams

(1)

(ii) What was the difference between the mass of the leaf of species **P** and the mass of the leaf of species **Q** after 5 hours?

..... grams

(1)

(iii) The leaf of species **Q** lost water at a faster rate than the leaf of species **P**.

Suggest **one** reason why.

.....

.....

(1)

(iv) Which weather conditions would cause the greatest rate of loss of mass for both species **P** and species **Q**?

Tick (✓) **one** box in the table.

Weather conditions		**Tick (✓)**
Still air or wind	**Temperature in °C**	
Wind	30	
Still air	30	
Wind	20	

(1)

(c) Draw a ring around the correct answer to complete the sentence.

In very hot, dry conditions, the stomata close.

This is to prevent

- anaerobic respiration.
- breathing.
- wilting.

(1)
(Total 6 marks)

49 Mycoprotein is produced from the fungus *Fusarium*. Mycoprotein is sometimes used instead of meat in foods for vegetarians.

(a) The table shows the amounts of some substances in mycoprotein and in chicken.

Substance	Mass in grams per 100 grams	
	Mycoprotein	Chicken
Protein	11.8	22.0
Dietary fibre	4.8	0.0
Fat	3.5	6.2
Carbohydrate	2.0	0.0
Cholesterol	0.0	0.1

(i) Draw a ring around the correct answers to complete the sentence.

Eating mycoprotein instead of chicken helps to lower the risk of heart disease because

mycoprotein contains no [fat / carbohydrate / cholesterol] and

mycoprotein contains less [dietary fibre. / fat. / carbohydrate.]

(2)

(ii) A body-builder ate 4 kilograms of chicken each week to help him build up his muscles.

If he ate mycoprotein instead of chicken, he would need to eat about twice as much to have the same effect.

Use information from the table to give **one** reason why.

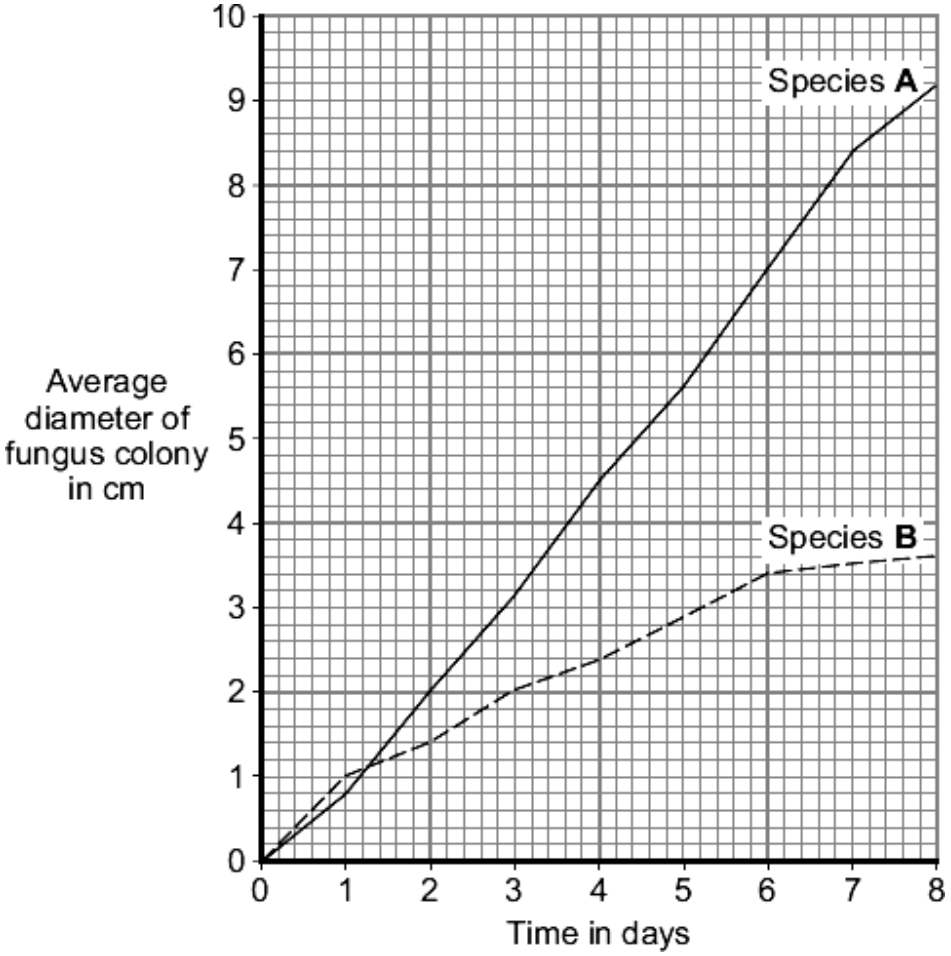
.....

.....

(1)

(b) Scientists investigated the growth of two species, **A** and **B**, of the fungus *Fusarium*.
The scientists grew the fungus on agar jelly in Petri dishes.
They measured the diameter of a colony of each fungus every day for 8 days.

The graph shows the results.



(i) Describe how the diameter of the colony of species **A** changed between day 0 and day 8.

.....

.....

.....

.....

(2)

(ii) Give **one** difference between the results for species **A** and the results for species **B**.

.....

.....

(1)

(c) Both Petri dishes contained the same nutrients.
Both Petri dishes were kept at 25 °C.

When *Fusarium* is grown in an industrial fermenter, other factors also need to be controlled.

Give **two** of these other factors.

1 .....

2 .....

(2)
(Total 8 marks)

50 Oxygen is transported round the body by the blood.

Blood leaving the human lung can carry about 250 milligrams of oxygen per litre.
However, only 7 milligrams of oxygen will dissolve in one litre of water at body temperature.

(a) Suggest an explanation for the difference.

.....

.....

.....

.....

(2)

(b) Blood leaving the skeletal muscles during exercise may contain only 30 milligrams of oxygen per litre.

Explain what causes the difference in oxygen concentration between the blood leaving the lungs and the blood leaving the skeletal muscles.

.....

.....

.....

.....

.....

.....

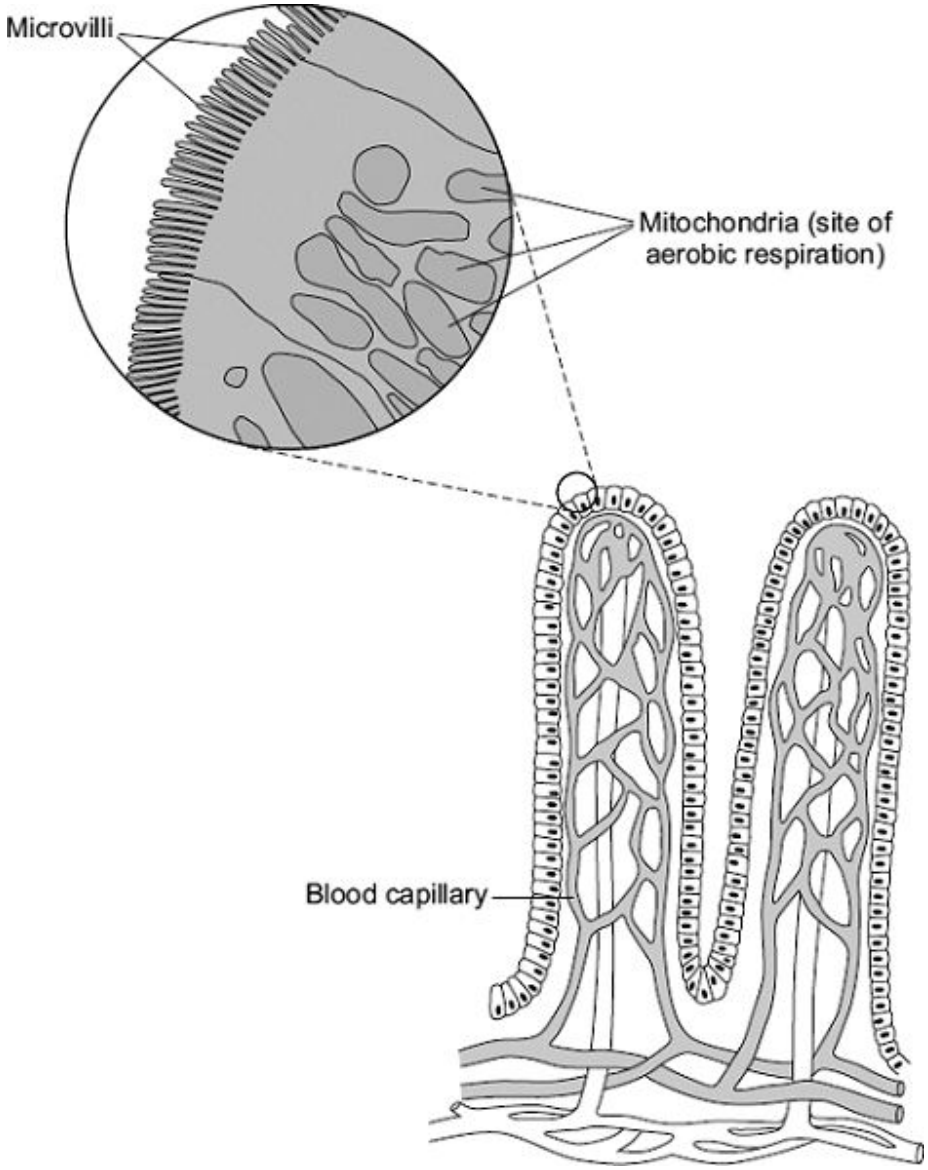
.....

.....

(4)
(Total 6 marks)

51 The villi of the small intestine absorb the products of digestion.

The diagram shows two villi. It also shows parts of some of the surface cells of a villus, as seen with an electron microscope.



Describe and explain how the villi are adapted to maximise the rate of absorption of the products of digestion.

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

(Total 5 marks)

52 Medicinal drugs are used to treat diseases.

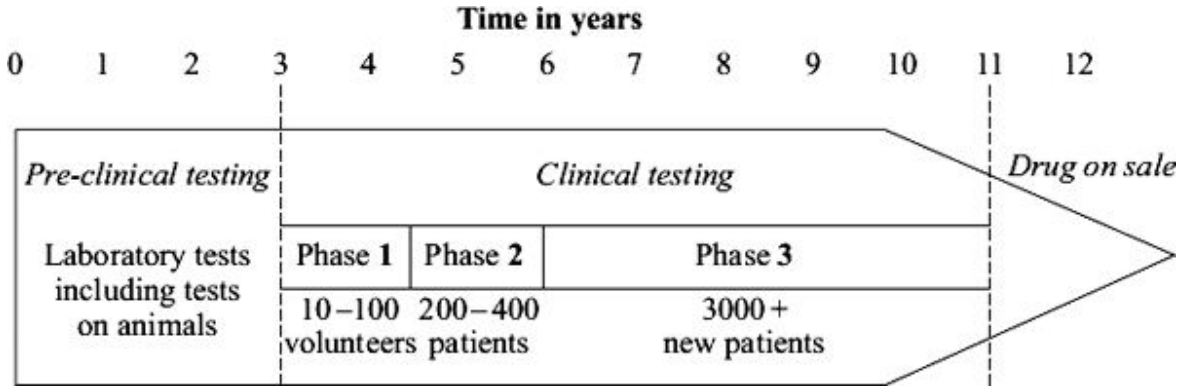
(a) Draw **one** line from each drug to its correct use.

Drug	Use
Painkiller	Used as a fertility drug
Statin	Used to relieve disease symptoms
Thalidomide	Used to treat leprosy
	Used to lower blood cholesterol

(3)

(b) New drugs need to be tested before going on sale.

The diagram shows a time line for the testing of a new drug.



(i) How long do trials on humans take? ..... years

(1)

(ii) What is the minimum number of humans the drug is tested on throughout *clinical testing?*

.....

(1)

(c) Draw a ring around the correct answer to complete each sentence.

(i) A new drug is first tested in the laboratory to find

if it is toxic.
if it is cost effective.
the optimum dose.

(1)

(ii) The drug is then tested on a few volunteers to find

if it is cost effective.
if it has side effects.
the optimum dose.

(1)

(Total 7 marks)

53 A group of pupils investigated the digestion of fat by the enzyme lipase.

(a) What **two** substances are produced when fats are digested?

Tick (✓) **two** box.

Glucose ☐

Fatty acids ☐

Glycerol ☐

Amino acids ☐

(2)

In the investigation:

- the pupils set up five test tubes
- each tube contained 1 cm^3 of fat and 10 cm^3 of lipase solution
- each tube was kept at a different temperature for 24 hours.

(b) (i) Give **one** control variable in this investigation.

.....

(1)

(ii) What was the independent variable being investigated?

.....

(1)

(c) The pH of the solution in each tube was tested at the beginning of the investigation and after 24 hours.

The results of the pupils' investigation are shown in the table.

Tube	Temperature in °C	pH at the beginning	pH after 24 hours
1	0	Neutral	Neutral
2	20	Neutral	'Weak' acid
3	40	Neutral	'Strong' acid
4	60	Neutral	'Weak' acid
5	80	Neutral	Neutral

One pupil said, "We might **not** have found the best temperature for the lipase to work".

What more could they do to find the best temperature?

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(2)

(d) The pupils then placed **Tube 1** into a water-bath kept at 40 °C.
The tube was left in the water-bath for 24 hours.

(i) What pH would you expect the contents of the tube to be after the extra 24 hours?

Tick (✓) **one** box.

Neutral ☐

'Strong' acid ☐

'Weak' acid ☐

(1)

(ii) Give the reason for your answer.

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(1)
(Total 8 marks)

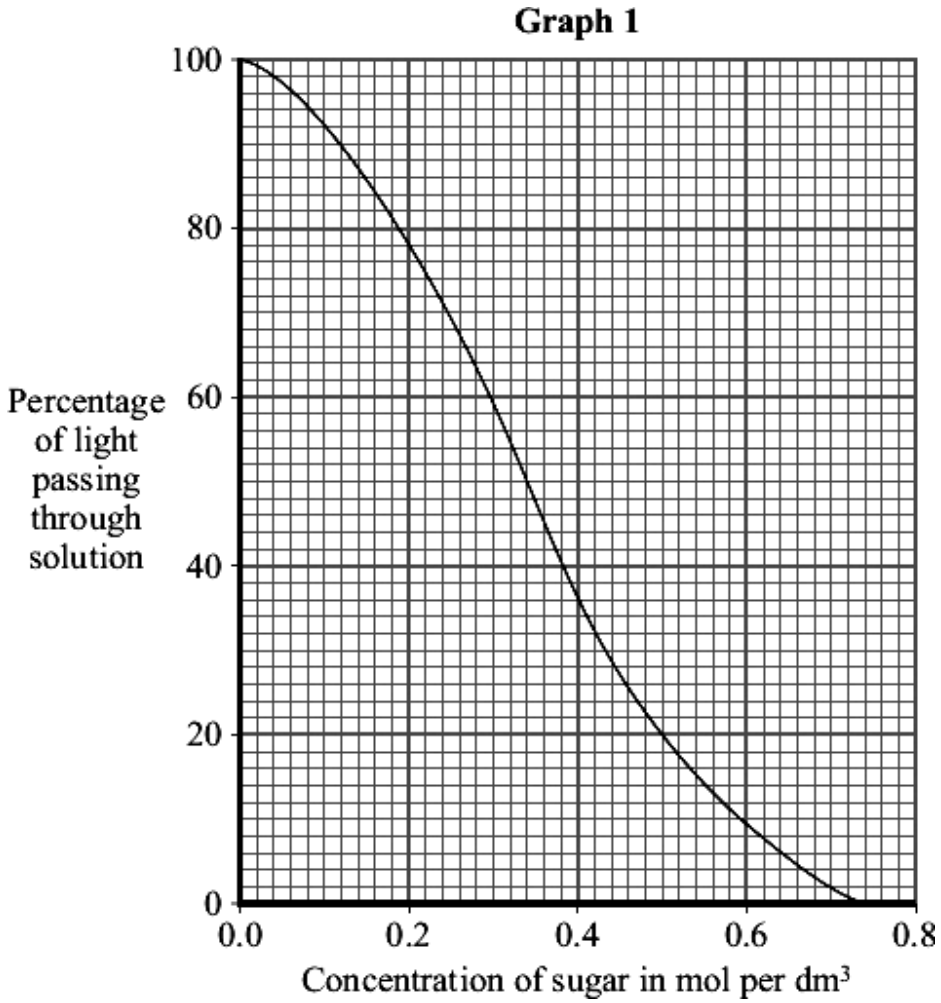
54 Starch is broken down into sugar by amylase. Amylase is produced in the salivary glands.

(a) Name **two** other organs in the digestive system which produce amylase.

..... and .....

(2)

(b) A colorimeter measures colour intensity by measuring the percentage of light that passes through a solution.
Graph 1 shows the percentage of light passing through sugar solutions of different concentrations to which a test reagent has been added.



Students used a colorimeter to compare the starch-digesting ability of amylase enzymes obtained from two organs, **P** and **Q**.

- The students collected 5 cm^3 samples of amylase from **P** and **Q** and placed them into a water-bath at 40 °C.
- Two test tubes containing 10 cm^3 samples of starch solution were also placed into the water-bath.
- All the tubes were left in the water-bath for 10 minutes.
- Each amylase sample was added to one of the tubes containing the starch solution.
- The test tubes were placed back into the water-bath.
- Every minute, a few drops were taken from each tube, the test reagent was added and the percentage of light passing through this solution was measured in the colorimeter.

The tubes containing amylase samples and starch solution were left in the water-bath for ten minutes before the amylase was added to the starch.

Explain why.

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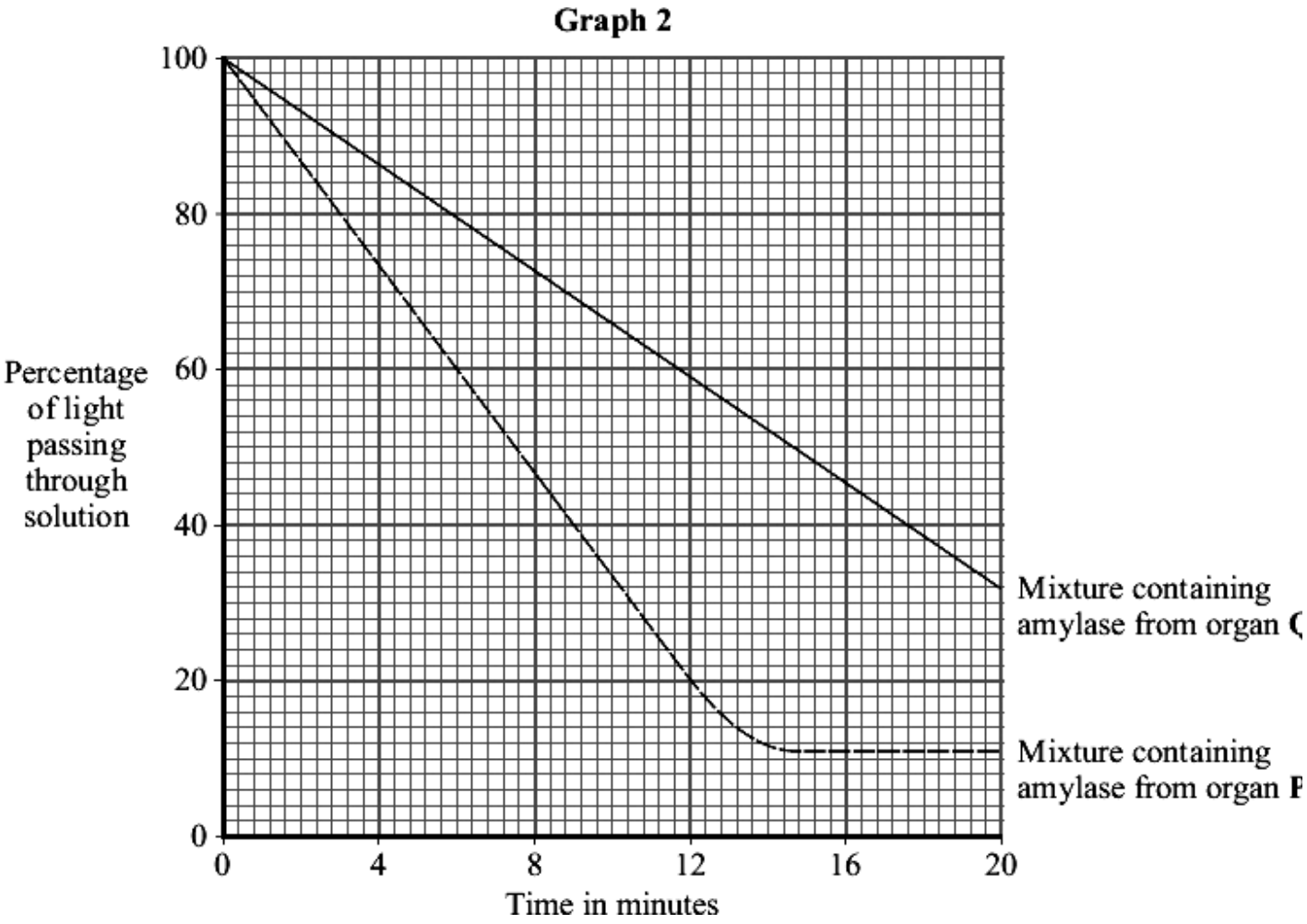
(2)

(c) **Graph 2** shows how the readings from the colorimeter changed over the next 20 minutes.



(i) Use **Graph 1** and **Graph 2** to determine the concentration of sugar in the mixture from organ **Q** after 20 minutes.

.....

Answer .....mol per dm^3

(1)

(ii) Use your answer to (c)(i) to calculate the rate at which sugar was produced in the mixture containing amylase from organ **Q**.

Show clearly how you work out your answer.

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.....

Answer .....mol per dm^3 per minute

(2)

(iii) Suggest why the amount of light passing through the mixture from organ **P** did not change after 16 minutes.

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(1)

(iv) One of the students suggested that they could have completed their experiment more quickly if the temperature of the water-bath had been set at 80 °C.

This would **not** have been the case.

Explain why.

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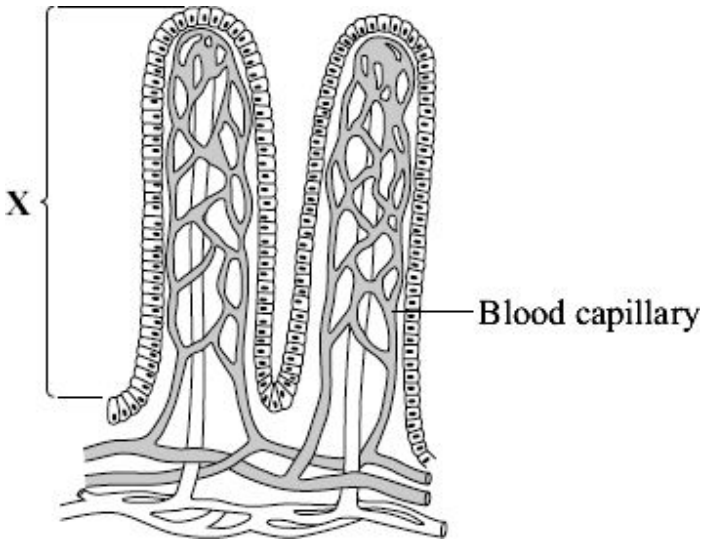
(2)

(Total 10 marks)

55 The diagram shows part of the lining of the small intestine.



(a) (i) Name structure **X**.

Draw a ring around **one** answer.

alveolus **thorax** **villus**

(1)

(ii) Choose **three** ways in which structure **X** is adapted to help the absorption of soluble food.

Tick (✓) **three** boxes.

It is ventilated. ☐

Its outer surface is one cell thick. ☐

It has a large surface area. ☐

It contains a layer of muscle. ☐

It has a good blood supply. ☐

Its cells contain haemoglobin. ☐

(3)

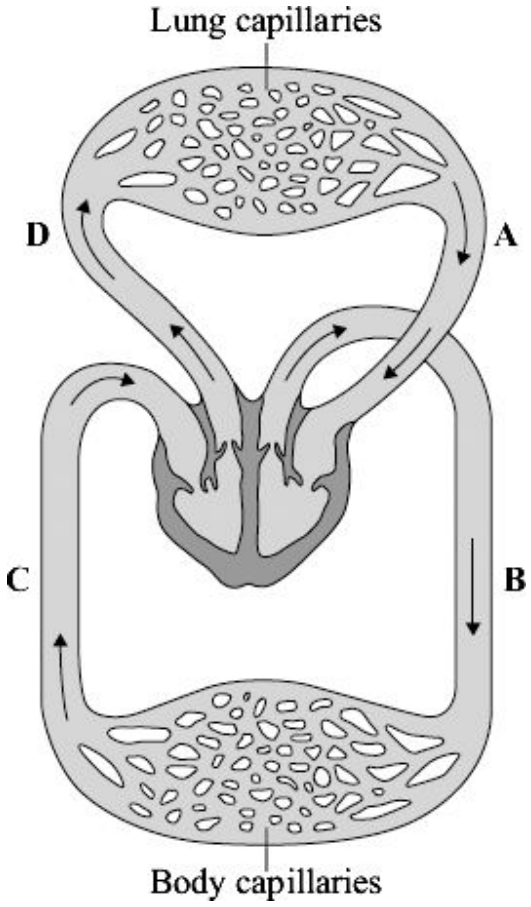
(b) Name the process by which soluble food enters the blood.

Draw a ring around **one** answer.

diffusion **fermentation** **transpiration**

(1)
(Total 5 marks)

56 The diagram shows the human circulation system.



(a) (i) Give the letter of **one** blood vessel that is an artery.

(1)

(ii) Give the letter of **one** blood vessel that carries oxygenated blood.

(1)

(b) During exercise, the heart rate increases.

Explain, as fully as you can, why this increase is necessary.

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(4)
(Total 6 marks)

57 A student removed three similar leaves from a plant. The student spread petroleum jelly (a waterproofing substance) on some of the leaves, as follows:

Leaf A: on the lower surface

Leaf B: on the upper surface

Leaf C: none.

The student placed each leaf in a separate beaker. He weighed each beaker at intervals. The results are shown in the table.

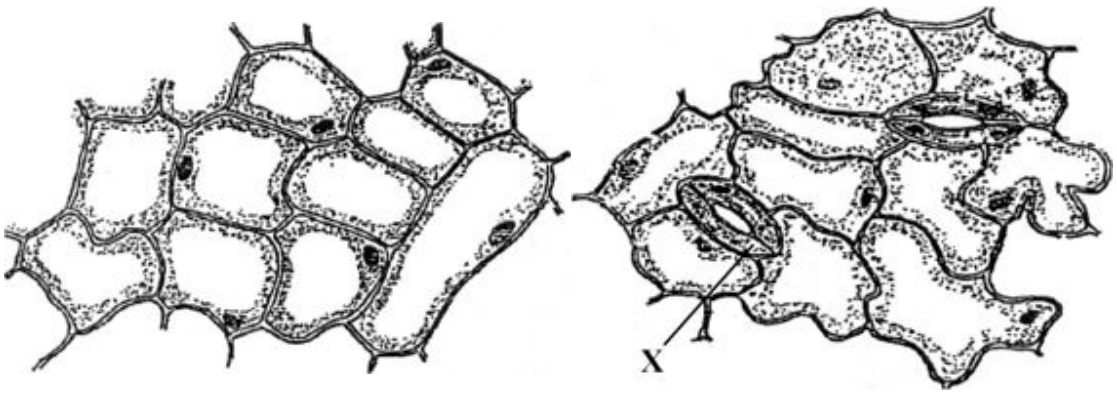
Time in hours	Mass of leaf + beaker in grams		
	Leaf A	Leaf B	Leaf C
0	50.00	55.01	51.99
0	49.99	54.95	51.90
3	49.97	54.90	51.85
5	49.95	54.86	51.80

(a) Which leaf, **A**, **B** or **C**, lost most water? ☐

(1)

(b) The diagram shows the appearance of the upper and lower surfaces of one of the leaves under a microscope.

Upper surface of leaf **Lower surface of leaf**



(i) Name cell **X**. .....

(1)

(ii) The petroleum jelly had a greater effect when it was spread on the lower surface than when it was spread on the upper surface.

Use information from the diagram to explain why.

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.....

.....

(2)
(Total 4 marks)

58 Diet and exercise affect health.

(a) Many people are obese (very overweight).

Obesity can lead to heart disease.

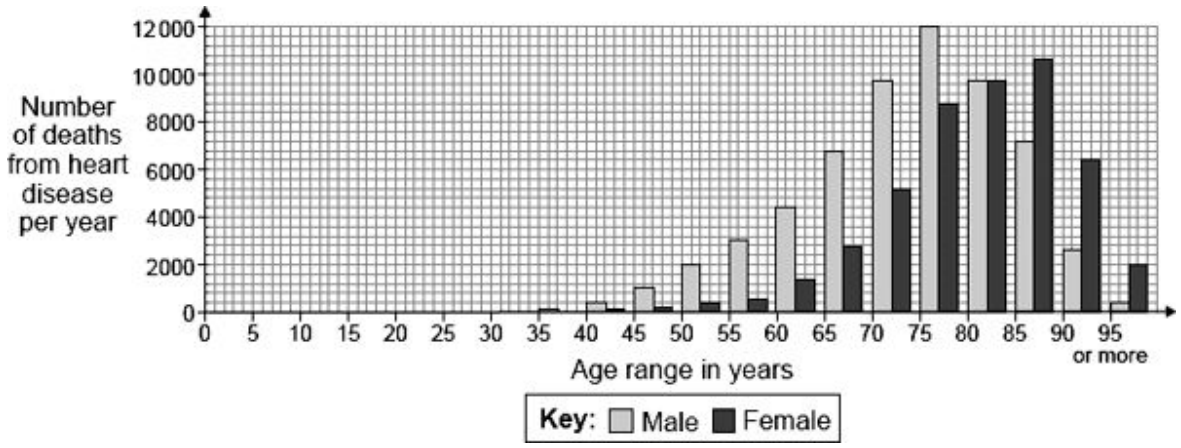
Other than heart disease, name **two** conditions which are linked to obesity.

1 .....

2 .....

(2)

(b) The graph shows the number of deaths from heart disease each year in the UK.



The pattern for deaths from heart disease in men is different from the pattern in women.

(i) Give **two** differences between the patterns for men and women.

1 .....

.....

2 .....

.....

(2)

(ii) Suggest **two** reasons for the difference in the number of deaths from heart disease in men and women between the ages of 40 and 60.

1 .....

.....

2 .....

.....

(2)

(c) Scientists have developed drugs to reduce the concentration of cholesterol in the blood.

Give the **three** main stages in testing a new drug before it is sold to the public.

1 .....

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2 .....

.....

3 .....

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(3)
(Total 9 marks)